ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LV, No. 11. CHICAGO, SATURDAY, SEPTEMBER 11, 1909 ISSUED WEEKLY

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY.

CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO.

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall.

Editors:
CHARLES W. PRICE. A. A. GRAY. F. H. BERNHARD.
Associate Editors:
H. FARRINGTON. J. M. C. HAMPSON. H. EHRLICH.

SUBSCRIPTIONS.

One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each . .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIAL:
Street Lighting as a Comprehensive Problem 455
The Electric Lighting and Illuminating Engineering Number ... 456
Popularizing Telephone Service 457
The Conservation of our Natural Resources Through the Use of High-Efficiency Lamps 457
Details of Watt-Hour Meter Manufacture.—V 458
Convention of the Illuminating Engineers 460
ELECTRICAL NOTES FROM GREAT BRITAIN 461-462
Third Annual New York Electrical Show 463
Meeting of the Central Electric Railway Association 464
CONVENTION OF THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES —DINNER TO MR. AND MRS. EDISON 465
The American Mining Congress 469
Action Against Canadian Hydroelectric Commission 469
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
The Problem of Domestic Lighting 470
Commercial Tests on Systems of Illumination 472
Special Carnival Illumination at Poughkeepsie 475
Developments in Arc Lighting 477
The Illuminating Engineer 479
Tungsten Sign Lighting 479
Gift to Institute Library 479
Convention of the Municipal Electricians 481
CENTRAL STATION PRACTICE—TRANSMISSION—INTERIOR WIRING:
The Buying of Coal on a Heat-Unit Basis 482
Gas Engines for Small Central Stations 484
INDUSTRIAL POWER:
Power Used in the Re-Manufacture of Lumber, With Special Reference to Central-Station Energy for That Purpose 484
Electric Power in Breweries 486
Electric Pumping; How Not to Do It 486
TELEGRAPHY—TELEPHONY AND WIRELESS:
Effect of Phase of Harmonics Upon Acoustic Quality 487
Fighting Forest Fires with the Aid of the Telephone 489
ELECTRO-CHEMISTRY AND METALLURGY:
Recent Progress in Electric Steel Refining 490
ELECTRICAL ADVERTISING AND SELLING:
Getting Power Business 492
Central-Station Advertising Made Effective by Appealing to Children 493
The British Association Meeting 494
INDUSTRIAL SECTION:
The Hawthorn Flaming Arc Lamp 496
Aurola Flaming Arc Lamps for Alternating Current Equipped with Rapid Striker 497
Newest Types of Excello Flaming Arc Lamps 498
Subway Transformers 498
Wheeler Fluted Street Reflectors 499
Some Interesting Features About Tungsten Lamps 499
Dale Lighting Specialties 499
The "Tungsten" Life-Saver 502
The Illumination of Mills and Factories with Small Units 503
Transformers for Tungsten Street Lamps 505
Westinghouse Series Tungsten Lighting Systems 506
Progress in the Westinghouse-Nernst Lamp System 507
Intensified Arc Lamp 508
Progress with the "I-Comfort" System of Indirect Illumination .. 509
Co-Operation Based Upon Commercial Common Sense 510
CURRENT ELECTRICAL NEWS 511
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 517
RECORD OF ELECTRICAL PATENTS 519

Copyright, 1909, by Electrical Review Publishing Co.

STREET LIGHTING AS A COMPREHENSIVE PROBLEM.

It is a singular fact that while street lighting is one of the oldest branches of central-station service, it appears to be no nearer standardized than many of the latest electrical applications. The advent of the tungsten filament, adapted to series operation on alternating-current circuits, and the recent development of luminous and flaming arc lamps of various designs, have changed the street-lighting situation in so many communities that the manager with an expiring contract on his desk often feels himself at a loss as to the equipment and prices desirable in new negotiations. Hence there is a natural tendency to attack the local problem by piecemeal methods, trying different illuminants in different sections of the city, going through long calculations of the cost of operating various systems, based largely upon the estimates of the sales engineer, presenting arguments for and against various pet schemes, and trying to back up the company's proposition by scattered tests of the candlepower of the units suggested, probably made with difficulty and perhaps with uncertain accuracy, on account of the unfamiliarity of the staff with measurements of this kind under service conditions on the street.

The amount of money which is expended by even the smaller cities yearly for street lighting is large enough to justify expert treatment of the problem in many instances. It will easily cost a city of 50,000 to 100,000 inhabitants from $1,000 to $2,000 a week to light its streets half decently, to use a Rooseveltian adverb. Offhand, the installation of a modern system of street illumination looks simple enough, but in reality the problem of adopting a system which shall give reliable service, permit advances in the art to be adopted later without excessive cost, produce first-class illumination, and prove to be highly efficient in its demands upon the station and its effect upon the power-factor, if the plant is of the alternating-current type, is one requiring for its solution a comprehensive knowledge of costs, installations and equipment under many different sets of conditions. Many managers doubtless possess such information in more or less satisfactory form, for such figures are often circulated privately in the central-station field while being kept from publication, because they usually represent operating costs only, and as such would be misinterpreted in the hands of the layman. Not a few managers, however, are unprovided with the results of street-lighting service in other comparable situations, and through no fault of their own are

not in positions to judge with acute criticism and forecasting the applicability of unusual apparatus to their localities. It is a long and arduous process to determine a rate for street lighting which will give a reasonable return upon the investment after all fixed and operating charges are met, and here is certainly a chance for the engineering expert who has had special opportunities to observe conditions and workings in this field to be of the greatest service to the central stations and the cities which are far-sighted enough to command his judgment. There is a strong belief in certain quarters that street lighting ought to be made more profitable to the central station; that it is often unremunerative in proportion to the trouble it causes; that the apparatus is bulky in proportion to its capacity, in the station layout; and that altogether too little money is appropriated for a proper street-lighting service in the territory.

If the problem is treated in a broad way and handled by the expert having a close knowledge of the limitations of the case, both the city and the company will be the gainers. The interests of the two are singularly alike in relation to the present developments in equipment. The city authorities want as much light as possible without disproportionate expenditures, and the company desires, under good management, to provide the community with first-class service of the highest economy, which means a minimum expenditure of energy for a given quantity of illumination. What should never be forgotten is the fact that the city is interested in light, while the company is interested in energy. If the municipality can be furnished with more light for the same money, through an economy of energy at the lamp or elsewhere in the system, the result will be beneficial all around. Every effort should be made to discourage the purchase of the same light for less money, for there is need in most cities of a more liberal illumination of the streets, leaving out of the case the more or less uncertain aid provided by mercantile lighting. Here the specialist of wide experience can step in and convince the local authorities that an under-lighted town is thereby an economic sufferer, while the local central-station man might only be accused of trying to saddle the municipality with heavier bills. Whether the local central-station manager decides to handle all the details of the street-lighting problem or not, the line of successful treatment lies along the direction of complete comparisons with the work in other cities of similar size, including specifications as to the type and size of lamp, hours of use per year, relative cost of generation and distribution, influence of sign and window illumination, probable cost of handling and maintaining the system in toto and per lamp, character of light and magnitude of illumination at specified distances from the unit on the street, lamp-hours or candlepower-hours per dollar expended, lamp cost per kilowatt-hour delivered at the terminals, and the actual experience of other companies with similar apparatus. Economy and minimum investment call for the treatment of main and side streets together, when possible, and for the arrangement of circuits to reduce the cost of trimming to the lowest possible terms, which sometimes means the re-distributing of the trimming districts without attempting to trim circuits separately. The amount of energy required for the street lighting of a city may not be impressive, but the extreme length of the circuits and the scattered character of the lamp installations create conditions which deserve to be studied closely in the interest of all-around efficiency.

THE ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING NUMBER.

A considerable portion of this issue is devoted to the presentation of developments in electric lighting and illuminating engineering. At the risk of platitudinizing we venture to say again that in no other field of electrical development has there been such rapid growth and such conscientious assimilation of ideas looking toward the better utilization of electrical sources of illumination. In this number will be found several noteworthy contributions from those who have been particularly prominent in this field. In addition to these, the manufacturers have been generous in the extreme in assisting in the preparation of articles devoted to special lines of endeavor which come under a broad grouping of manufacturing, engineering, and application of electric lighting and illumination data.

Electric lighting and illumination, however, is but one department of effort in the great field of electrical engineering, and consequently, the other departments have in no wise been neglected. Coincident with the great activity which is now opening up extraordinary opportunities for new business and further applications of electrical engineering, there have been inaugurated in this issue certain changes in the make-up of the journal which will render it more than ever of value to its great circle of readers in concentrating in departmentalized sections all of that material which appertains to each division of work. This is the day of concentration, and the busy man must have every facility for easy access to that reading which essentially and primarily interests him. No effort will be spared to make these departments more complete and in future issues other lines will will be taken up which the large amount of material available for this issue has unavoidably crowded out.

One of the latest propositions which has as its basis a broad scheme of co-operation between central station operators, supply dealers and contractors is that recently worked out by one of the manufacturing companies whereby a complete plan is outlined and working material prepared for a thorough campaign on the part of the central station operator, and involving also a co-operative scheme by which the contractor or supply dealer is interested in taking care of the business developed through the central station campaign. With this plan the central station manager creates a desire for use of more current and makes the initial installation. The new business developed by reason of this pioneer work is then handled by the supply man or contractor. The plan has many features which makes it worthy of careful scrutiny.

POPULARIZING TELEPHONE TOLL SERVICE.

In many communities the economic value of telephone toll service is but little appreciated by the public at large. There is a feeling that such service is too expensive except for use in important emergencies; that the expenditure of money for a "long-distance" talk is justified only by some extreme condition, perhaps one which could not be met by the sending of a telegram—an awesome undertaking in the minds of not a few good but conservative citizens. It is true that an enormous proportion of the telegraphic service in this country is purely commercial, largely centralized about the stock market, the railroads and the newspapers. This ought not to be so to such a great extent, and if the telegraph companies would adopt energetic campaigns of publicity, combined with further efforts to improve the speed of their service, it is probable that within a year or two the amount of personal traffic handled could be doubled or trebled. Probably less than five per cent of the present business is individual in character. If there is small excuse for the failure to save time and strength by the more general use of the telegraph in social and small business relations, there is less for the lack of appreciation found in many places of the usefulness and cheapness of toll telephone service.

Telephone managers need no instruction as to the value of their service to the public, but the people at large do. The manager must advertise his product, but he must present the subject from the standpoint of the hard-headed citizen of small affairs and from the point of view of the feminine customer whose natural instincts are to save considerable sums yearly by rigid economies in numerous small expenditures.

In order to reach this class of business, special attention must be drawn to a number of points, not necessarily all at a time, but in a definite and convincing way. In all live communities the value of time is coming to be appreciated as never before, and this is the chief theme to employ in advertising toll service. Let the manager compare the cost of a three-minute talk, in which two or three hundred words can be said on each side, with the cost of a personal trip to the distant point. Thus, it may cost twenty-five cents to talk to a city fifty miles away, or a net price of twenty-five-hundredths of a cent per mile for the round trip. Even at two cents per mile railroad fare the cost of the journey alone, exclusive of any value upon one's time in traveling, is thus eight times what the telephone bill amounts to. Adding a small sum like thirty cents per hour as a reasonable unit value of the time of many persons, we find that the trip in person costs probably from ten to fifteen times the trip by telephone. Again, let the manager emphasize the value of a positive appointment contrasted with a haphazard trip on the mere chance of meeting the desired person, and let him put down in black and white the time required for mail collection, transmission and delivery compared with the few moments required to connect up the distant city and party desired by the telephone. Each locality affords a field of special study and countless variations in instructive publicity.

THE CONSERVATION OF OUR NATURAL RESOURCES THROUGH THE USE OF HIGH-EFFICIENCY LAMPS.

At the recent Quebec meeting of the Canadian Electrical Association, Mr. S. E. Doane, Chief Engineer of the National Electric Lamp Association, read a paper entitled, "The Conservation of Our Natural Resources Through the Use of High-Efficiency Lamps." At a time when attention, far and near, is riveted upon the all-absorbing topic of the conservation of our natural resources, this is, indeed, an artful suggestion. Mr. Doane, however, adds to ingeniousness a sober analysis of conservation considerations, and he draws a convincing connection between wasteful methods of fuel consumption and the betterments which may be brought about by the universal use of the newer forms of high-efficiency units.

With the liberal replacement of other forms of illuminants by high-efficiency lamps, the rate at which fuel is being consumed could be reduced enormously. But, says Mr. Doane, "There has been a hesitancy upon the part of the central station men to place the tungsten lamp upon his circuits."

Mr. Doane points out that there is a necessity for a change in the methods of charging by central stations. Charging on a flat meter basis, which assumes to take into consideration both fixed and casual expenses, is inequitable to both consumer and central station man; and, in the long run, works the greater injury to the central station.

The development of the high-efficiency lamp with its reduction in energy consumption for the same amount of light has been viewed with alarm by the central station man, and, were it not for the energetic campaigns which have resulted in increasing either the illumination desired by the individual, or placing upon the circuit a larger number of consumers, considerable inroads would have been made into his revenue. The possibility of increasing the efficiency of incandescent or any other forms of electric lamps makes the analysis of Mr. Doane's suggestions of particular and timely importance.

Fixed charges to cover fixed expenses is the summation of all that Mr. Doane expresses. Once the proper relation of the consumer's responsibility for the equipment which he compels the central station to install in order to be at all times ready to give him service is established, there will be little difficulty in indicating to him the justice of the readiness to serve charge. It would seem to follow then, that, having established the justice of a readiness to serve charge, and this being the case, having collected it, there is a greater opportunity than ever for the central station to sell its current at a reasonable profit and increase this profit surely as the customer becomes better able to make his pocket keep pace with his desires.

It is highly improbable that there will be available a clean-cut proposition whereby a more accessible and logical system of charging can be worked out immediately; but there is apparently a necessity for close study of this matter, and Mr. Doane's suggestions are surely a good basis from which to start an investigation.

DETAILS OF WATT-HOUR METER MANUFACTURE.—V.

BY JOSEPH B. BAKER.

FACTORY INSPECTION AND CALIBRATION OF INDUCTION METERS.

Following is an account of the final factory inspection and calibration of Westinghouse type C induction meters, constituting details of their manufacture:

Mechanical Inspection.—The so-called "mechanical inspection" takes place after the meters are tested, but before they receive the final checking. The meters to be inspected are hung in rows on specially constructed racks, and are connected in series with a standard. The dial hands on all of the meters are put at zero, and the positions of the dial hands of the standard are noted. The circuit is then closed, and the meters are run for a certain period of time, at the end of which the individual registrations of the meters under test are compared with the registration of the standard.

The final operation is a very severe application of a blast of compressed air to all interior parts of the meter, following which the covers are placed on the meters, wing-nuts tightened, and the meters turned over to the checkers for the final electrical tests before shipping.

General Calibration Method and Equipment.—A "master meter," hereafter termed simply a "master," is mounted on a special cast-iron rack, for convenience, and calibrated from a precision wattmeter on all loads from two per cent of full load up to full load. The master is equipped for having extraordinarily fine settings made of its adjustments, such as a screw for shifting the permanent magnet (full-load adjustment).

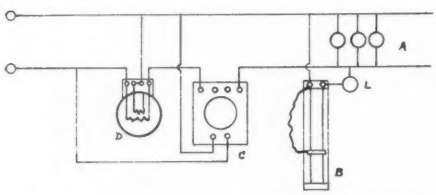


FIG. 35.—CONNECTIONS FOR CALIBRATION OF METERS.

The connections for adjusting the load by the use of the precision wattmeter are indicated in Fig. 35. In this A is the lamp bank, giving approximate load on the meters under test—full load, or any desired percentage of full load; B is a slide-wire rheostat in circuit with a single lamp (L), for giving the fine adjustment of the load; C is the precision wattmeter, and D is the (two-wire single-phase) meter under test. A form of slide-wire rheostat is used for this purpose.

It is a matter of considerable time to get a master calibrated; and it is constantly referred to the precision wattmeter as a precaution against any change of calibration. From this master other meters are calibrated (by synchronizing) for use as working "standards" on the different testing racks. These standards are never reset while in use on the testing racks. They are kept sealed while in use and under the exclusive supervision of the man in charge of the Standard Division, who checks them frequently with the master.

The integrity of the standard is insured by the fact that the checking of the product of meters at different stages—for example, by the testers who make full-load and light-load adjustments and the adjustments to unity power-factor, and later by the "checkers," who give the meter a final test before sealing and shipment — is by different individual standards of those which have been synchronized with the master. Therefore there is no chance for the standards themselves to get out of calibration without immediate discovery.

The accuracy and completeness of the tests made by the principal manufacturing companies, as a regular detail of the manufacture of meters, are perhaps not generally realized. For example, the following tests and adjustments are made on all Westinghouse induction meters, in the order given, before the meters are finally sealed for stock or shipment. The actual work of setting the adjustments of the product of meters is done by experienced operators. Several operatives work at each of a number of testing racks, on which is mounted one of the synchronized standards.

It may be stated here that the test department is instructed not only to test the finished meters, but to watch all the details of manufacture. By this organization the chance of imperfect material or workmanship, or incorrectly set adjustments, getting into the product is almost eliminated.

Full-Load Adjustment.—To make the full-load adjustment, the voltage is adjusted for the given testing rack by a specially designed potential regulator.

This potential regulator is made out of an induction-type fan motor, by securing what would ordinarily be its rotor (secondary) on a rod, with hand-holds at convenient intervals, running the length of the rack. By turning the rod, the secondary may be shifted into any desired angular position with relation to the primary, so as to control the voltage on the rack.

The operative then places the meter to be calibrated in series with the standard, and directly underneath it on the rack, and adjusts the load to make the standard run at the rate of twenty-five revolutions per minute.

Turning now to the meter under calibration:

As described elsewhere, the pair of meter magnets are carried in a "shoe" having a heavy brass back-plate or yoke, by means of which they are secured to the meter shield. The slotted ends of the yoke fit closely into machined grooves on either side of the shield, and are bound firmly to the latter by four heavy screws passing through the slots and tapped into the shield. This mounting gives a positive alinement of the magnet's air gap with the disk, and at the same time a wide range of adjustment of the magnetic system.

In making the adjustment on the meter under calibration, the binding screws are loosened and the shoe is shifted—backward or forward, so as to cause the magnets to enclose a greater or smaller portion of the disk and thereby to "damp" the latter more or less—till the disk is brought into true synchronism with the standard. As synchronism is approached, a fine adjustment of the magnetic system is obtained by loosening the screws on one side of the latter only, and "rapping" the shoe one way or the other.

As in commutator meters, the setting of the full-load adjustment affects the light-load accuracy equally.

Light-Load Adjustment.—The light-load adjustment is one of the most interesting features of this make of induction meter.

It is of great importance to have a long range of light-load adjustment. Deterioration of bearings has only slight effect on the accuracy of a meter at full load, but great effect on its accuracy at light load. A well-designed meter (irrespective of its practical construction) should not change much on full load with length of service; but on light load the damping magnets have practically no control. The magnets should always remain unchanged, so that there is no reason for change of full-load accuracy. On the other hand, the setting of the light-load adjustment of induction meters, like the shifting of the shunt-field coil in commutator meters, affects the light-load accuracy, mainly through a wide range of

the movement of the strip; the full-load accuracy is only slightly affected. Variation of jewel friction counts for little on full load, inasmuch as, in the first place, friction is at most only a trifle greater, its increase being not at all proportional to increase of speed; and in the second place, the value of the friction at full load bears a very small proportion to the counter-torque of the damping magnet.

It should be noted at this point, in passing, that meter inspectors have a tendency to make use of the light-load adjustment too far up on the light-load scale. Thus, ten per cent of full load is a point outside the legitimate province of the light-load adjustment, since at the speeds corresponding to such load the damping magnets control; whereas, in the vicinity of two per cent of full load they do not control. Therefore, loads in

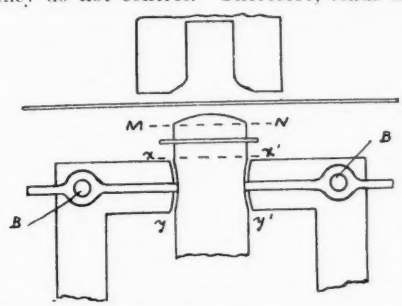


FIG. 36.—PARTIAL ELEVATION OF SHUNT AND SERIES FIELDS AND DISK.

the neighborhood of two per cent of full load are within the legitimate province of the light-load adjustment. It is important to bear in mind this principle of keeping the light-load adjustment within its own province. For example, if the inspector finds the meter abnormally slow on light load (over five per cent or six per cent) he should not at once proceed to set the light-load adjustment, but should look for and remove the cause of such a gross error. On the other hand, a setting of the light-load adjustment at loads exceeding fifteen per cent will cause abnormal inaccuracy of the meter at loads below that test load.

To summarize this important point; setting the light-load adjustment on loads above a genuine light load (five per cent for induction meters) is as illogical as would be the shifting of the damping magnets to effect light-load adjustment.

In the actual setting of the light-load adjustment, the procedure is to reduce the load on the testing rack till the standard makes one-half revolution per minute, indicating two per cent of full load. The tester then sets the adjustment till the meter under test synchronizes with the standard. The range of the light-load adjustment is so great that only a slight change of position of the shading strips is necessary to effect a considerable change in calibration. This adjustment, once set, should not vary. It ought, therefore, to be independent of the series field of the meter, which varies with the load on the meter. In the Westinghouse type C induction meter this adjustment is obtained by putting in each of the two leakage gaps of the shunt field a short-circuited loop, or "shading strip," the position of which may be adjusted in the gap at a greater or less distance from the exciting coil, as shown in Fig. 36, which is a partial elevation of the shunt and series fields and the disk, looking from the front of the meter (see also H, H, in Fig. 21, page 388 of the issue of August 28). These loops (Fig. 37) are made of a high-copper alloy having low temperature coefficient and not too high conductivity, *i. e.*, not too low a resistance for the amount of material necessary for mechanical strength.

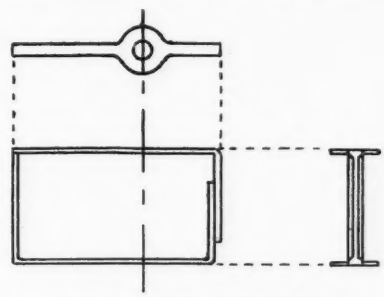


FIG. 37.—THE "SHADING" STRIP.

By loosening the screws B—which are tapped into the shield and serve also, with other screws passing through the shunt-field core, to secure the latter on the shield—the light-load adjustments may be tilted from the mid-position in which they are shown into any angular position between the limits indicated by the directions Bx and By and also Bx^1 and By^1, respectively. Since the screws B are at the centers of the circular arcs at the shunt-field air gaps in which the loops lie, the latter will clear the iron throughout their entire range of adjustment—an angle of about twenty-five degrees. The loops become the seat of weak eddy currents, of constant mean value, because generated wholly by the shunt-field flux; and the weak fluxes due to these currents, by reacting upon the disk currents, exert a constant slight additional torque upon the disk which serves to compensate for the retarding effect of mechanical friction. Varying the position of loops H, H, in their air gaps varies the compensating effect as may be necessary to correct for friction error.

The operation of this pair of angularly adjustable short-circuited loops constituting the light-load adjustment may be explained more at length, as follows:

The induced currents set up in one of the loops by the shunt-field flux would react on that flux, thus causing a local resultant field, which, reacting in turn upon the eddy currents set up in the disk, would cause rotation of the disk irrespective of and without interference with the principal reaction between the shunt and series fields of the meter. The placing of one loop on each of the two side poles of the shunt field thus gives two local fields, tending to rotate the disk in opposite directions and enables a balance to be obtained between them by setting the loops so that one of them traverses a stronger or weaker region of the field in its air gap than the other loop traverses in the other air gap. In the mid-position of the loops shown in Fig. 36 the two local torques will balance each other, giving zero resultant torque and friction compensation. But by moving one of the loops, thus unbalancing the pair of local fields, the resultant torque may be given any desired value, between maximum positive torque—*i. e.*, torque additive to the main torque of the meter—with the right-hand and left-hand loops in the positions Bx and By, respectively, and maximum negative torque—that would result in backward rotation of the disk on no load—with the loops in the position By and Bx^1, respectively.

[To be continued.]

Longest Telegraph Circuit.

Persia and its capital, Teheran, have been very much before the public lately, but probably few people are aware that the news which has come through to London has passed over the longest telegraphic circuit in the world.

The distance between London and Teheran by wire is 4,000 miles, and the operator in Teheran communicates direct with the operator at the London end, automatic repeaters taking the place of operators at ten places along the circuit. The first repeating station from London is at Lowestoft, where the wires enter the North Sea, beneath which they run for 200 miles, to Emden, Hanover, where the second automatic repeater continues the message. Thence it is flashed to Berlin, Warsaw, Rouno, Odessa, Kertch, Sukhum, Kaleh, Tiflis and Tauris, from each of which stations it is instantaneously forwarded without human intervention, the telegraphist at Teheran, who receives the message from Tauris, being the first operator to handle it since it left London. From Teheran the line then extends to India, but nowhere else is there a circuit so long as that between Teheran and London.

Convention of the Illuminating Engineers.

As already announced several weeks ago, the Illuminating Engineering Society will hold its third annual convention in the Engineering Societies Building, 25 to 33 West Thirty-ninth Street, New York city, on September 27, 28 and 29.

The convention committee, composed of E. L. Elliott, chairman; Walter A. Addicks, Henry L. Doherty, Dr. A. H. Elliott, Dudley Farrand, Dr. A. C. Humphreys, J. H. Jourdan, J. W. Lieb, Jr., and W. C. Morris, is making rapid progress in all the final arrangements for this important gathering.

Convention sessions will be held as follows: Opening and routine business—Monday, 2 p. m.; technical papers and discussions—Tuesday, 8 p. m., and Wednesday, 10 a. m. Among the entertainment features will be a reception and musicale on Monday evening; review of the historical parade arranged for the Hudson-Fulton celebration on Tuesday morning; inspection of the special illumination in this connection on Wednesday evening. A number of special entertainment features for the ladies are being arranged.

An exhibition of gas and electric lighting devices of the latest commercial types, as well as a historical and educational exhibit showing the progress of the art of illumination, will be made in the building at No. 5 West Thirty-ninth Street, near the convention headquarters. This exhibition will be open to the public throughout the week of the convention and Hudson-Fulton celebration.

The spectacular illumination in connection with the latter event should alone prove of special interest to illuminating engineers, as it has been predicted that all efforts in decorative and display lighting ever attempted heretofore will be exceeded by the novelty and magnitude of the effects to be carried out on this occasion. Added to these attractions is an excellent programme of technical papers worthy of the most careful consideration. The titles and authors of the principal papers were given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of August 21, page 339.

Members of the society and others expecting to attend this convention should notify the secretary of the Illuminating Engineering Society, Preston S. Millar, 33 West Thirty-ninth Street, New York city, so that advance copies of the papers may be sent to them. It is requested that these papers be studied in advance as much as possible, so that the time devoted to the technical sessions may be given up chiefly to the discussions of the various papers that will be presented in abstract only.

Rules for Service and Meter Wiring.

The Edison Illuminating Company, and its subsidiary concern, the Peninsular Electric Light Company, both of Detroit, Mich., have issued the following "Central-Station Rulings for Service and Meter Wiring." These should be of interest to other central stations throughout the country.

TO ELECTRIC-WIRING CONTRACTORS.

In wiring buildings to be connected to our mains, please conform to the following rules:

Service Wiring.—All service entrances should be on the rear wall of buildings. If, because of unusual conditions, this is not practicable, please confer with our sales department as to the placing of the entrance point. Service wires should be carried out of building in service pipes at least ten feet from the ground, and pipes should not in any case be wired with smaller than No. 10 wire. Two feet of wire must be left at the top of the pipe for the splicing of our wires. The service pipe for two apartment buildings should be wired three wire, the two apartments being balanced against each other at distributing point.

Meter Wiring.—Meter loops must be in a dry, accessible place, within four feet of the service entrance, and not more than seven feet from the floor. If it is necessary to place the meter a greater distance from the entrance point, the wires must be carried in conduit. Meters will not be placed on lattice partitions, or walls subject to vibration. Meters will not be installed in restaurant kitchens or similar places, when it is possible to put them elsewhere, but in any case where meters are so installed, a box to cover the meter, eighteen inches wide, twenty-eight inches high and twelve inches deep, must be provided by the customer. In no case will meters be installed over a stove or sink. Meters must be at least ten feet, and, where possible, fifteen feet, from all generators and motors. Meters must be separated by at least twenty inches between centers (both vertically and horizontally). Meters must not be located within three feet of conductors carrying heavy currents. Plans for large installations and special work, such as placing meters on switchboards, high-tension work, etc., should be submitted to the sales department of this company for approval before any work is done by the contractor. Specific instructions on service pipes and sizes for motor wiring have previously been issued to contractors. Copies of these instructions may be procured from our office.

Wireless in the Argentine.

It is reported that the Argentine Government has appropriated $75,000 gold to establish wireless telegraph stations between Buenos Aires and Ushuaia. The work, it is said, must be finished on or before May, 1910.

Instructors for Chicago Technical High Schools.

The Board of Education of the city of Chicago will hold a special examination on September 17 and 18 for teachers of electrical construction, mechanical drawing and foundry work. A number of these positions are open in both the day and evening technical high schools of the city. The examination will cover both general and technical subjects. Applicants should call upon or at least communicate without delay with the examiner's office, Board of Education, Room 829 Tribune Building, Chicago, where application blanks and statement of the detailed requirements may be obtained.

Chicago Electric Club.

At the meeting of the Chicago Electric Club, Wednesday, September 1, the regular plan of this club's meetings was resumed, the meetings during the month of August having been devoted to entertainment.

The speaker on this occasion was W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, and he chose for his subject, "Conservation of Natural Resources." Mr. Abbott's remarks, however, related principally to atmospheric conditions in the past and present. He also made some amusing suggestions regarding these conditions in the future.

British Cable Rates Reduced.

Dating from August 1 last, the rates for press telegrams between Great Britain and the countries mentioned have been reduced as follows, inasmuch as the British, Indian and Australasian governments have agreed to bear their ratable share of the reduction: India and Burma, nine pence (eighteen cents) per word; Ceylon, nine-and-a-half pence (nineteen cents); Australia, Tasmania and New Zealand, nine pence. The press rates to South Africa have also been reduced by about six cents a word.

Sierra and San Francisco Power Company.

Ladenburg, Thalman & Company announce that the transfer of the property of the Stanislaus Water Power Company to the Sierra & San Francisco Power Company has been completed. This is the source from which the United Railroads of San Francisco is to receive its waterpower, and negotiations have been under way for the past year.

Electrical Notes From Great Britain.

By Our British Correspondent.

Last month I gave a few details regarding the past year's working of the municipal electric trolley system of Glasgow. I have now received the full report on the operation of the electric-light and power supply department of that city for the same period. Several causes combined to decrease the income by some $38,600—reduction charges for current, the extensive adoption of metal-filament lamps, and general trade depression—but as there was an all-round decrease in working expenses, there is actually an increase in the available profit balance, which is $704,000, as compared with $690,000. As, however, increased provision has been made for depreciation and sinking fund there is really a net deficit of $17,700 for the year. The provision for depreciation amounts to $266,000. The department added 1,232 new consumers, making a total of 18,158, and the motors on circuit numbered 4,292 and aggregated 29,508 horsepower, an increase of nearly 6,000 horsepower on the year. Out of nearly thirty-three millions of units sold, nearly eighteen millions were for power purposes, and of these, roughly, twelve millions produced one-and-one-half cents per unit.

Reference to the particulars of the various generating stations shows that at the Port Dundas station three marine water-tube boilers with economizers and fans have been erected, completing the present boiler house, but an extension is being built. A new grab transporter for lifting coal from barges has been rendering good service for some months. In the engine room a fifth turbine of 5,500 horsepower, with its alternator and condensing plant, has been added, bringing up the capacity of the station to 28,000 horsepower. Transforming plant of 2,000 horsepower erected at this station has assisted flexible and economical running of the Port Dundas and Pollokshaws Road generating stations at times of light load. Energy at extra high pressure is transmitted from Port Dundas to a number of substations, as well as to Pollokshaws Road, if necessary. The trunk main connections between Pinkston power station (tramways) and Port Dundas have been used frequently during the year. At Pollokshaws Road two new water-tube boilers and economizers have been added, the coal store has been covered in, and a third 5,500-horsepower turbo-generator has been erected, bringing up the total of this station to 21,700 horsepower. A new substation at Hoggs Road contains two 1,000-kilowatt sets, and this plant is satisfactorily meeting the needs of the southwestern district of the city. Six large consumers are economically supplied through transforming plant (aggregating 3,000 horsepower) placed in their premises.

The Institution of Mechanical Engineers held its annual summer meeting in Liverpool from July 27 to 30, with J. A. F. Aspinall, general manager of the Lancashire and Yorkshire Railway Company, as president. Three papers that came before the gathering call for mention here, namely, one by Prof. F. W. Burstall on the indicating of gas engines, giving the results of an investigation to ascertain what the error in the indication of such engines amounted to; this work was undertaken as the Institution of Civil Engineers Gas Engines Committee reported several years ago that the indicating of gas engines was open to very much greater errors than was the case with steam engines. The second was a paper by Arthur Maginnis on "Advance of Marine Engineering in the Early Twentieth Century," in the course of which he predicted an extensive application, before long, of electric drive for propeller shafts. He pointed out the advantages of electricity if applied to drive slower-going cargo tramps. The introduction of main driving would commence a new era of electric navigation. The other paper, "Electrical Operation of Textile Factories," by Herbert W. Wilson, has been abstracted in a previous issue.

The Madras (India) electric-light and power undertaking is, after delays, now making constructional progress. The concession, which was obtained by Crompton and Company, Limited, of London, was sold to the Madras Electric Supply Corporation, Limited, an English company, the purchase agreement stipulating that they should have the contract for the installation. In arranging the contract no penalty was attached to failure to complete within a given time. Two years was considered ample, but later it was thought that by accelerating the time current might be available by September, 1907. The great delay is stated to have raised a legal question between the two parties. At a meeting of the corporation just held in London it was stated that the station buildings were practically complete, these including the Mylapore substations. For the town supply there will be 2,000-kilowatt, direct-current plant for fans and lighting, and for tramways and workshop uses 1,500 kilowatts, alternating-current plant. The tramways will take a minimum of 1,000,000 units per annum. The Madras Port Trust is probably to take 40,000 units per annum. There appears, with these and other important consumers, to be every prospect of doing a satisfactory and progressive business when once the supply is fully available.

The firm of Crompton and Company, Limited, just named, is one of the oldest electrical manufacturing concerns in England, and India has been for some years among its chief markets. The past year has not been one of its rosiest on record, and the unsatisfactory net result called forth many remarks regarding trade depression in England and some of its causes, at the meeting recently held in London. The municipal electrical fever of several years ago led to such an increase in the manufacturing power of the country, so that when the excitement abated there was unhealthy competition, reducing prices to a profitless level. Other causes named were: Want of governmental support of industry; the lack of financial industrial institutions, such as supported enterprise in other countries; general want of confidence owing to the acts of the particular government in power; the lack of capital being invested in British industry, and the remarkable British investments in foreign and colonial undertakings. There is not believed to be any prospect of prices immediately improving, and the company is turning attention to certain special lines of manufacture, where a larger margin of profit is expected than is obtainable from the sale of standard lines, where there is so much competition.

International-exhibition arrangements are receiving a great deal of attention just now as a result of very special efforts that are being made to interest manufacturers and other possible exhibitors in two good shows that are being organized for next year and others following thereafter. As the outcome of frequently expressed desires, a new government policy of rendering the British exhibitor assist-

ance of real value at international events of this kind is being introduced for the first time at Brussels next year. More inducements to, and facilities for exhibiting are being offered than on any previous occasion. This same progressive policy will enter into the organization of the British exhibits at the Rome and Turin displays, which follow. It may prove to be somewhat unfortunate that the Brussels exhibition will be held in the same year as the Anglo-Japanese show, which is planned for London, for manufacturers will probably regard both shows as calling for large and costly exhibits if any at all are resolved upon, and they may decide to do the thing properly at one rather than have two poor shows. In regard to the Anglo-Japanese exhibition, though this does not come under the government's new policy alluded to above, it is said to have the cordial support of the British government, and to be under the auspices of the imperial government of Japan, while it has the blessing of King Edward and the Emperor of Japan, the support of British chambers of commerce being also assured. The White City grounds and buildings at Shepherd's Bush will be utilized, and the Kiralfys are, of course, connected with it. Prince Arthur of Connaught, who is president, in an effort to stimulate interest in behalf of the event, says: "The unique character of the exhibition is sure to attract multitudes of people, not only from Japan, the United Kingdom, and the colonies and dependencies, but from every European country and from America, and cannot fail to increase the commerce of the two nations and to create new commercial channels between them and the rest of the world." The Imperial International Show, now running at the White City, from an industrial point of view, is more or less of a fiasco, and it will be interesting to see whether a number of firms do not prefer the Brussels exposition to that at Shepherds Bush in 1910.

The Metropolitan District Railway is certainly finding its feet again, for it has just completed a splendid half year both in regard to increased traffic and receipts and decreased working expenses. All over the system there has been a general increase of traffic, so that the passenger income has reached a record figure (£254,000 for the half year) exceeding by £10,900 the highest previous figure, which was obtained in the last half of 1908, when the Franco-British Exhibition was bringing large crowds to London. The thirty-three millions of passengers include an increase of 11.22 per cent over the first half of 1908, and there was an increased car-mileage run of about 6.5 per cent. Two of the half-year's economies are particularly worthy of mention, one being a saving of £8,545 in the cost of electric current, the other being a substantial saving as well as a general improvement in the method of working the middle doors of the coaches. At a cost of £5,600 the air-worked doors have been altered to doors with handles, and the latter are giving greater satisfaction. Sir George Gibb, in addressing the shareholders on this point, mentioned that to have run the car mileage of the last half year with the air-worked doors would have cost £4,000 per annum more than had actually been the case. The number of employes required on the trains was reduced, of course, but they were drafted into other departments of the service. The net result of all the foregoing was an increase of £25,419 in gross revenue and a reduction of £6,733 in the gross expenses.

A scheme is shortly to be laid before the shareholders of the District Railway for the purpose of capitalizing the accumulated dividend deficiency on the guaranteed stock. This deficiency is about £250,000, or about twenty per cent of the stock's nominal value. The improvement in the position of the undertaking is regarded as making the times propitious for handling this matter most expeditiously.

It is announced that the Central London (tube) Railway extension from the Bank Station to Liverpool Street (the terminus of the Great Eastern Railway), which has just been sanctioned by Parliament, is to be proceeded with almost immediately. This short addition to the city end of the line will be more important for traffic-catching purposes than any other section of the railway. Large numbers of north and east London residents using the Central London have at present to walk from five to ten minutes through congested city streets, or take a 'bus ride and then descend to the tube at the Bank. The close connection with the Great Eastern and North London lines, which this extension will provide, will be of much convenience to the public, and it is expected to have a very healthy effect upon the future business of the Central London Railway. The Greenock municipal electricity works are to be extended at a cost of $62,000 to meet a demand from the Admiralty for the new torpedo factory, and also for current required by Scott's Shipbuilding and Engineering Company, which is to build one of the new Dreadnoughts, in connection with which work the company is putting down additional power-using plant. The company will pay the municipality two cents per unit for the first 500,000 units, 1.8 cents for the second 500,000, and 1.6 cents for all in excess of a million. The contracting firm which is putting down the new naval dockyard works at Rosyth, on the Forth, has abandoned the idea of taking energy from the Fife Power Company, and instead will put down its own installation to serve for driving the numerous electric cranes required and for lighting purposes during the considerable night operations that are involved in the contract. From Greenock and Rosyth to Cape Colony is a far cry, but it is interesting to mention here that the Cape Town Corporation Electricity Department has recently installed a good deal of new plant from which to give a bulk supply to the Cape Government Railways and the Table Bay Harbor Board. Babcock and Wilcox water-tube boilers, 600 brake-horsepower Belliss and Morcom steam engines driving two-phase 2,200-volt Siemens alternators, a Phœnix booster for raising the pressure from 440 to 550 volts for dock purposes, a battery station with chloride cells at the docks, and a General Electric motor alternator, are comprised in the new work, which, including duplicate cables to the railway and docks switchboards, has cost altogether about $125,000.

ALBERT H. BRIDGE.

London, August, 1909.

Exhibits at Denver Conventions Returned Free.

It is announced that the Trans-Missouri Traffic Association, which governs freight shipments between Chicago, St. Louis, etc., and Denver, will return free of charge all material sent to Denver for the exhibit to be held there in connection with the conventions to be held during the week beginning October 4 next by the American Street and Interurban Railway Association and the Colorado Electric Light, Power and Railway Association.

Members of the Manufacturers' Association have also been notified by the exhibit committee, which makes the preceding announcement, to request roads which belong to the association and over which they are shippers, for special rates in accordance with the above-mentioned concession.

The Third Annual New York Electrical Show.

The final details for the coming New York Electrical Show, to be held in Madison Square Garden, October 11 to 21, are rapidly nearing completion.

One of the special features of this year's show will be the great industrial exhibit representing manufacturing processes of all kinds utilizing electric drive. This exhibit will be of great interest to the hundreds of manufacturers in the vicinity of New York who are constantly on the lookout for every improvement that will increase production and promote the economy of operation.

The interior of the Garden will represent the highest attainment of the decorator's and illuminating engineer's skill and will present that distinctly uniform appearance which is so pleasing to the eye. More than 75,000 incandescent lamps will be used for illumination.

The number of exhibitors who have already taken space is far beyond expectations, and very little space remains unsold. The following list of exhibitors represents many of the leading manufacturing companies of the country, and their combined exhibits will make the greatest display of electrical and kindred appliances ever brought together under one roof:

The New York Edison Company, 55 Duane Street, New York; Goulds Manufacturing Company, 16 Murray Street, New York; Watson Stillman Company, 30 Church Street, New York; *Electrical World*, New York; United Shoe Repair Machine Company, 39 Warren Street, New York; Murphy Electricity Rectifier Company, Rochester, N. Y.; Fox Brothers and Company, 126 Lafayette Street, New York; Tucker Electric Construction Company, 110 West Thirtieth Street, New York; Shelton Electric Company, 105 West Forty-second Street, New York; Electric Suction Sweeper Company, 91 Wall Street, New York; The Heany Company, 25 Broad Street, New York; Manhattan Electric Supply Company, 17 Park Place, New York; Edison Electric Illuminating Company of Brooklyn, 360 Pearl Street, Brooklyn; The Crane Company, 519 South Canal Street. Chicago, Ill.; Electric Testing Laboratories, East End Avenue and Eightieth Street, New York; Duntley Manufacturing Company, Thirty-fourth Street and Broadway, New York; American Electric Lamp Company, 153-9 Jefferson Street, Chicago, Ill.; National Electric Lamp Association, 4411 Hough Avenue, Cleveland, O.; Harley Machine Company, 949 Broadway, New York; United Electric Light and Power Company, 1170 Broadway, New York; W. P. Pressinger Company, 1 West Thirty-fourth Street, New York; Keller Manufacturing Company, Philadelphia, Pa.; The Lansden Company, Newark, N. J.; Public Service Corporation of New Jersey, Newark, N. J.; Excello Arc Lamp Company, 30 East Twentieth Street, New York; ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago; Otis Elevator Company, 17 Battery Place, New York; The Westinghouse Company, 165 Broadway, New York; American Metal Hose Company, 173-7 Lafayette Street, New York; Electric Home Supply Company, 45 West Thirty-fourth Street, New York; Electric Cleaner Company, Monadnock Building, Chicago, Ill.; C. L. Kleiwert Company, 39 Cortlandt Street, New York; Empire Vacuum Company, 110 West Thirtieth Street, New York; Consolidated Telegraph and Electric Subway Company, 66 Lafayette Street, New York; Pelouse Electric Heater Company, 403-13 Ohio Street, Chicago, Ill.; General Vehicle Company, Long Island City, N. Y.; General Compressed Air and Vacuum Cleaner Company, 315 Fifth Avenue, New York; Stanley & Patterson, 23 Murray Street, New York; General Electric Company, 30 Church Street, New York; Roger Williams (The Simplex Electric Heating Company), 25 West Forty-second Street, New York; Economical Electric Lamp Company, 25 West Broadway, New York; Collins Wireless Telegraph Company, 54 Clinton Street, Newark, N. J.; Southern Exchange Company, 97 Warren Street, New York; Radio Reflector Company, 1178 Broadway, New York; German-American Electric Company, 110 West Fourteenth Street, New York; H. Krantz Manufacturing Company, 160 Seventh Avenue, Brooklyn, N. Y.

Staten Island Subway.

It was learned that the engineers of the New York Public Service Commission are at work on detailed plans for an extension of the Fourth Avenue Brooklyn subway from the terminus of that line at One Hundred and First Street and Fourth Avenue, Fort Hamilton, to Rosebank, Staten Island, and when the Fourth Avenue line is constructed and bids are asked for the extension to Staten Island, the Commission will have everything complete and ready for quick action.

These plans will call for an extension under the Narrows, as submitted by George Von Kromer, chairman of the Citizens' Tunnel Committee of Staten Island, and filed with the Commission last May. This extension will be about three miles long, and the entire mileage of the route from Manhattan Bridge to Staten Island will be 9.97 miles. The cost of the Fourth Avenue Brooklyn route is between $15,000,000 and $16,000,000, and the proposed extension will approximate $10,000,000.

Chicago's Proposed Subway.

A proposal that the city of Chicago consider G. W. Jackson (Inc.) as possible builder of an extensive subway system costing $80,000,000 will be made to Mayor Busse and the City Council this fall. No tentative ordinance outlining the terms of a prospective agreement has been drawn, but George W. Jackson, president of the corporation bearing his name, states that he is ready to take the first steps leading toward the drafting of such a franchise and the presentation of a formal proposition to the city.

Makes Big Investment in Chicago Real Estate.

It seems almost incredible that a piece of land in Chicago which sold for $450,000 last week should have been purchased in 1836 for $231, having increased in value 18,622 times, but that is the history of the W. W. Cole (the former circus man) property, which was purchased by George A. McKinlock, president of the Central Electric Company, for $750,000. In 1833 the entire block in which this property is located, containing 2.9 acres, was purchased by Hiram Pearsons for $231. A few months thereafter Mr. Pearsons sold the block to William B. Eagan at a profit of $20. In 1835 Mr. Eagan conveyed the block to E. K. Hubbard for $750.

The land fronts eighty-seven-and-one-half feet on Fifth Avenue and 163 feet on Jackson Boulevard, with an eighteen-foot alley on the west, and it is improved with a ten-story fireproof building worth more probably now than it was when originally built.

The purchase was made by Mr. McKinlock as an investment, but it is likely that the Central Electric Company may occupy a part of the structure when the present lease expires. The consideration was based on a valuation of $450,000 for the land, equivalent to $5,142 a front foot for the Fifth Avenue frontage, $2,941 a front foot for the boulevard frontage and $33.61 a square foot.

Second Avenue Railroad.

In an order filed on August 30 in the United States Circuit Court, Judge Lacombe granted the application of Davies, Stone & Auerbach, solicitors for the Guaranty Trust Company, of New York, and Quigg, Baldwin & Pierce, solicitors for the Second Avenue Railroad Company, extending the time for the taking of testimony in the foreclosure proceedings instituted by the Guaranty Trust Company, until November 9 next. The complainant is allowed until September 9; defendants from that time to October 9 to take their testimony, and the complainant is then given until November 9 to take testimony in rebuttal. In this notice Judge Lacombe again expressed doubt of jurisdiction.

According to the State Railroad Commission, there were 551 fatal and 5,427 non-fatal railroad accidents in Pennsylvania during the six months ended June 30. Of the fatalities, seventy-nine were on electric roads.

Meeting of the Central Electric Railway Association.

The first fall meeting of the Central Electric Railway Association, advanced from September, was held at the Cadillac Hotel, Detroit, Thursday, August 26. The meeting was notable for the large number of officials representing nearly every electric road in Ohio, Indiana and Michigan, who had made long-distance trolley trips to be in attendance at the first meeting of the association to be held in Michigan. The meeting was also noteworthy for the many entertainment features provided by the managers of the Detroit United Railway lines and city officials. It is understood that the September meeting was advanced to August in order to combine pleasure with the proceedings of the convention, and for this reason only one session was held to afford time for a pleasant excursion by boat on Lake St. Clair and an enjoyable luncheon at the Belle Isle Casino.

The convention was called to order by the president, A. A. Anderson, who immediately called for reports of officers and committees, and the preliminaries were soon out of the way. A resolution in condolence of the death of C. C. Reynolds, an active member of the association, who died at his home in Indianapolis June 26, was adopted with bowed heads.

Great interest was shown in the rapidly increasing development of the express business on electric railways as presented in a paper read by John H. Crall, general passenger and freight agent of the Terre Haute, Indianapolis & Eastern Traction Company.

Mr. Crall said, in part, that interurban express or dispatch freights is a feature of the traction business that has occasioned more or less controversy from the beginning, both as to the handling of the business and as to whether it could be made a revenue producer. He said the line with which he is connected has found that little additional capital or equipment is necessary to carry on the business by accepting shipments when delivered at its stations, transporting same and making station delivery only. That this plan has proven very satisfactory because of its quick delivery due to hourly service, is evidenced by the increasing amount of express matter carried by interurban roads adopting this plan. Mr. Crall described the manner in which the farmer or produce raiser communicated by telephone with the commission merchant or numerous customers relative to commodities. In consequence these were soon placed on board the cars, and in a short time delivered to the commission merchant at the city station. Likewise commodities are shipped to the towns, villages and even to crossroad stops in the country. The speaker suggested that the wasted space in the vestibule of the cars might be filled up with express shipments. He said that during the month of May the revenue from interurban express service on his lines was 6.14 per cent of the passenger earnings, and the space used in the cars for the express matter transported was 6.36 per cent of the total space in the cars. In other words, his lines earned as much from the space used in the cars for express as the corresponding space used for passenger traffic. Mr. Crall said it was a mistaken idea that interurban express or freight dispatch is of no importance other than a matter of accommodation. The business is not only a means of substantial revenue, but the possibilities for increasing it are more than flattering, and traction lines will, without question, be materially benefited by boosting the interurban express traffic.

In the discussion of Mr. Crall's paper C. N. Wilcox, general manager of the Cleveland, Southwestern & Columbus Railway, George Parker, general freight agent of the Detroit United Railway, E. F. Hyman, general manager of the Electric Package Agency, Cleveland, took the affirmative proposition and explained how and under what conditions straight express business was successfully conducted on their lines. J. H. Pardee, of Rochester, N. Y., and A. A. Anderson, general manager of the Indianapolis, Columbus & Southern Traction line, were inclined to believe there was little or no profit for the majority of roads; that it interfered with passenger service and they had found no inducement to encourage it. F. E. Hardie said that the Fort Wayne & Wabash Valley Traction Company was enjoying a satisfactory express business independent of a contract with the United States Express Company, which handles interline business over his road.

"The Development of Long-Distance Freight and Passenger Business" was the subject of a paper read by Frank D. Norviel, general passenger and freight agent of the Indiana Union Traction Company.

Mr. Norviel emphasized the ideal conditions under and by which the traction lines may enjoy a gradually increasing proportion of the passenger and freight traffic by describing in detail local conditions and situations. He stated that much of the interurban business was secured at rates equal to those of the steam lines because the service and accommodations are adequate for its needs. These conditions must be maintained and every comfort of the passengers looked after. He urged the necessity of encouraging factories to locate on the lines and building switches for their immediate accommodation. The leading feature of Mr. Noveil's paper was how to get long-distance passenger and freight business. He said this required something more and different from looking properly after local business. Among the requirements he cited the following: Tariffs for naming rates, clearly stating what an agent may do; a plan for a just division among roads; issuance of maps and time tables to passengers; arrangement for transfer of baggage at junction points; courtesy on the part of agents and train crews; and use of good, comfortable cars, well ventilated and thoroughly equipped for buffet meals and other necessities during a long-distance travel. The same rule applies to the securing of through freight. In conclusion, Mr. Norviel insisted that there is money in through business, and its future development is only waiting a more extended preparation for properly handling the traffic.

J. G. Forrester, of the Ohio Electric Company, Mr. Hardie, of the Fort Wayne & Wabash Valley, and F. W. Coen, of the Lake Shore Electric lines, discussed briefly some of the points brought out by Mr. Norviel and generally agreed with the proposition that there was much money in the through business.

Thomas H. Henkle, representing the Electric Service Supplies Company, with headquarters in Chicago, read an interesting paper on the subject of "Integrating Wattmeters and Their Application to Electric Cars." Mr. Henkle's paper was well received and brought out a number of questions which were answered by Mr. Henkle in a manner showing his familiarity with the subject.

The next bi-monthly meeting of the association will be held in Indianapolis November 18, 1909. S.

Long Island Electric Railway Company.

The New York Public Service Commission has approved the application of the Long Island Electric Railway Company for the reduction of its capital stock from $2,100,000 to $600,000. This company operates, by electric power, a street railway seventeen miles in length, extending from Brooklyn to Jamaica and Far Rockaway, with a branch running to Belmont Park.

It was brought out in the hearings that the company was originally organized with an authorized capital of $600,000, and in 1908 the road was consolidated with the New York & North Shore Railway Company. The authorized capital of this company was $2,100,000, but in the agreement it was stated that the capital stock of the Long Island company was $600,000 and the North Shore company $1,500,000. In addition, the property of the North Shore company was encumbered by mortgage bonds amounting to $1,261,000.

Interborough-Metropolitan Plan.

It is reported in Wall Street that the financial reorganization of Interborough-Metropolitan will be undertaken by J. P. Morgan & Company, Kuhn, Loeb & Company, and another leading international banking house. It is stated that the current fiscal year is certain to make results for the late year, surprisingly favorable though they were, look unfavorable by comparison.

Convention of the Association of Edison Illuminating Companies.

Dinner to Mr. and Mrs. Edison.

The Association of Edison Illuminating Companies held its twenty-fifth annual convention at Briarcliff Lodge, N. Y., Tuesday, Wednesday and Thursday of last week. The attendance was thoroughly representative, and the following programme was carried out in executive session and discussed at length:

First Session.

Tuesday Morning, 9:30 O'Clock.

Roll call.

President's address, W. W. Freeman, Brooklyn.

Report of executive committee, D. L. Huntington, secretary, Spokane.

Report of treasurer, Louis A. Ferguson, Chicago.

Report of committee on meters, Joseph W. Cowles, chairman, Boston.

Paper, "Prepayment Meters," F. G. Vaughen, Schenectady.

Report of committee on storage batteries, Ernest Lunn, chairman, Chicago.

Symposium, "The Tungsten Lamp Situation in Various Cities" (prepared from reports received by the president), E. A. Baily, assistant secretary, Brooklyn.

Second Session.

Tuesday Evening, 8:30 O'Clock.

Address, "Combination Lighting and Railroad Loads," Samuel Insull, Chicago.

Report of committee on incandescent lamps, John W. Lieb, Jr., chairman, New York.

Third Session.

Wednesday Morning, 9:30 O'Clock.

Report of committee on National code, Wm. C. L. Eglin, chairman, Philadelphia.

Report of committee on high-potential disturbances, W. F. Wells, chairman, Brooklyn.

Report of committee on steam turbines, Alex. Dow, chairman, Detroit.

Paper, "New Low-Pressure Turbine Installations," W. L. R. Emmet, Schenectady.

Paper, "Gas Power," I. E. Moultrop, Boston.

Paper, "Standard Colors for Power-Station Piping," J. P. Sparrow, New York.

Fourth Session.

Wednesday Evening, 8:30 O'Clock.

Report of committee on electric heating and kindred uses of electricity, John F. Gilchrist, chairman, Chicago.

Paper, "Special Illumination Feature of the Hudson-Fulton Celebration," Arthur Williams, New York.

Paper, "The Central Station and the Electric Vehicle," F. M. Tait, Dayton.

Paper, "Commercial Problems," John F. Gilchrist, Chicago.

Paper, "Electro-Chemical Processes as Applied to Central-Station Service," C. J. Russell, Philadelphia.

Fifth Session.

Thursday Morning, 9:30 O'Clock.

Report on fire insurance, including claims for standard insurance, mutual insurance and individual insurance funds, presented by request of the executive committee from information obtained by the president.

Paper, "Notes on a Neglected Phase of the Insurance Question," Caryl D. Haskins, Schenectady.

Paper, "Rules for Employes from a Legal Viewpoint," James V. Oxtoby, Detroit.

Introduction to discussion, "The Present Condition of the Edison Tube System," W. F. Wells, Brooklyn.

Paper, "Rotaries vs. Motor-Generator Sets for Central-Station Service," C. W. Stone, Schenectady.

Election of officers and executive committee.

Adjournment.

OFFICERS ELECTED FOR 1909-10.

The following were selected as the officers for the ensuing year:

President—Thomas E. Murray, New York.

Vice-President—Charles R. Huntley, Buffalo.

Secretary—N. T. Wilcox, Lowell.

Treasurer—L. A. Ferguson, Chicago.

Executive Committee—Thomas E. Murray, New York; Samuel Insull, Chicago; C. L. Edgar, Boston; J. W. Lieb, Jr., New York; J. B. McCall, Philadelphia; W. W. Freeman, Brooklyn. Ex-Officio—Charles R. Huntley, Buffalo; N. T. Wilcox, Lowell; L. A. Ferguson, Chicago.

The entertainment was of a varied nature, including automobile rides, organ recitals, and golf and archery contests. The chief entertainment event was a trip Tuesday afternoon on the steamer *Glen*

THOMAS E. MURRAY,
President Association of Edison Illuminating Companies.

to West Point and return. This was a delightful affair in every way, a fine orchestra being on board, and luncheon served.

BANQUET TO MR. AND MRS. EDISON.

The dinner in honor of Mr. and Mrs. Thomas A. Edison occurred Thursday evening, September 2, and was a very notable event. The banquet committee, consisting of Samuel Insull, chairman; Charles L. Edgar, John W. Lieb and W. W. Freeman, planned and carried to successful issue one of the most enjoyable and impressive occasions in electrical convention history. The large dining room was most beautifully decorated with vines, flowers and tiny incandescent lamps to the number of many thousands. The table of honor was a great oval, at which seventy were seated, with Mr. and Mrs. Freeman and Mr. and Mrs. Edison at the head. Smaller side tables were arranged for the other diners, also decorated with tiny lamps and flowers.

After the conclusion of the excellent dinner, President Freeman said:

The programme of the evening does not include a formal array of speeches, although, as is well known, we have present this evening a large number of those whose talent in that direction is well understood. The committee, however, has felt that the presence of our guests of honor here in itself is sufficient to make the occasion truly memorable. All that is desired is to give adequate expression to the pleasure which we all feel in the honor of having with us tonight Mr. and Mrs. Edison.

In these times it seems true that we only appreciate the really great things or the really small things by comparison—the ten-story building in the smaller city is a greater wonder than our forty or fifty story skyscrapers in New York. The young lad born in the small country town on the banks of a tiny streamlet thinks he has a mighty river flowing through his town, until, perchance, he becomes familiar in later life with the wonderful Hudson, the beauties of which we have been enjoying for the past few days, and then he smiles at the comparison which he makes in his mind with the tiny stream at home. With reference to our guests of honor this evening, our particular guests, it is certainly true that time and perspective create no diminution of regard and wonderment.

We esteem it one of the greatest privileges that our association could enjoy to have Mr. Edison with us. While his genius has been too great to be circumscribed within the lines of our activities, and while in recent years his efforts have been put forth in somewhat other directions, still it will always be a source of particular pride to those engaged in the electrical industry, and still more particularly of the members of the association which bears his name, to learn of his accomplishments and to give praise for them; and it would seem that our feeling in respect to the special association of Mr. Edison with the members of this small company is somewhat shared, by the presence of Mr. Edison on an occasion of a character which he seldom honors with his company.

We are particularly proud to have with us not only Mr. Edison, but Mrs. Edison, whose presence gives us equal honor, and Miss Edison, and the other members of the family. I propose a standing toast to the guests of the evening:

To Mr. and Mrs. Edison—"May the years of health and enjoyment in store for them be as numerous as the benefits which Mr. Edison's genius has conferred upon mankind."

There is no one to whom quite so much credit for the success of the arrangement for our gathering this evening is due as to the chairman of our committee, to whom we are indebted for the presence of Mr. and Mrs. Edison, and for much of the arrangements of the evening. It gives me great pleasure to introduce for an address, and for such other formalities as he may see fit to inaugurate, Samuel Insull.

MR. INSULL'S ADDRESS.

I have the very pleasant duty to perform to thank you, on behalf of our two guests

of honor this evening, Mr. and Mrs. Edison, for the very cordial way in which you have received them this evening, and for the very handsome entertainment that you have afforded them on this occasion.

It is a peculiar pleasure for me to be able to speak for them, as it is now upward of thirty-one years since I first entered the Edison service, and I am still, I hope, as enthusiastic in it as i was in 1879, two years before I met Mr. Edison.

It is a very great pleasure to us—I am now speaking as a member of the Association of Edison Illuminating Companies—to be honored by Mr. and Mrs. Edison's presence, and it is more particularly a pleasure to us when we hear from them, as we have during last night and today, that they consider that the attention we are paying them is a very great honor to them.

It is now upwards of twenty-five years since the first Edison station was started in New York, and if those around this table will look back to September, 1882, when that station was started on Pearl street, a little south of Fulton street, and remember the difficulties encountered in raising the capital to establish that business—difficulties which were almost insurmountable, apparently, to the capitalists who stood behind the enterprise—they will recognize that it would have been impossible to have started the station but for the personal credit extended to the institution by Mr. Edison through his manufacturing establishments which he owned at that time,

The money raised by one of the leading banking houses in America at that time was insufficient to finance the plant of the Edison Electric Illuminating Company of New York, and it was Mr. Edison's personal fortune that enabled the starting up of the Pearl street station, and it was Mr Edison's manufacturing establishments that had to wait for their pay until that station was a financial success. I think that fact is probably as great a tribute to the genius of the inventor as anything we can possibly imagine, because, I think, if you will search the annals of new industries you will fail to find a case where the original money invested paid a return on the investment to clear off the floating debts without the subscription of additional capital by those who had the courage to put their money in, in the first instance.

We have today, scarcely more than a quarter of a century since the first experiments were started at Menlo Park, business that employs in our branch of it not less than one thousand millions of dollars—a business that, whether it be the running of a small plant in a hotel like this, or the harnessing of the mighty natural forces of Niagara, or the enormous steam generating plants in all our large cities, in all systems of electrical distribution—these are impossible of operation unless the inventions made by our honored guest are used every day and every week by all of us, and it is a matter of common use for us to do so. I care not what you may have followed, whether it has been in the development of the power business, whether it has been in the development of the alternating current system, whether in the development of transportation, or whether in the development of the various forms of electric liging—those are but matters of detail. The transcendent genius that gave us the great engineeering monument of a distribution system must be credited now and for all time to the illustrious inventor whose name our association bears.

Mr. Insull then read letters and telegrams of regret from C. A. Coffin, Theo. N. Vail, Elihu Thomson, Charles Batchelor, S. Bergmann, John I. Beggs, R. R. Bowker, Capt. Wm. Brophy and others.

Mr. Insull called on E. H. Johnson to speak, saying that it was through Mr. Johnson that he came to this country.

MR. JOHNSON'S ADDRESS.

I have the honor to be the oldest associate of Mr. Edison in his work in this room. In the fall of 1870 I came to New York from Colorado at the summons of some friends to look into an enterprise in which they were interested, and, to make a long story short, they found themselves in considerable difficulties, and the question arose: Who is the man to lead us out of this difficulty? A young friend of mine, at that time associated with a big financial establishment in Wall Street, namely, Col. Josiah C. Reiss, who is present here this evening, got up and said: "I have heard of a young fellow over in Newark by the name of Edison; they tell me he is a great genius; he has wonderful inventive faculties, and I believe he is the man to get us out of this trouble." I said: "Yes, I have heard of that fellow; he was a telegraph operator originally, but has done some wonderful work in electrical matters." They proposed to send for him, and a resolution was passed at the meeting that afternoon to send for Mr. Edison and have him come over and meet me, and I was to pass on his qualifications and decide whether he knew anything.

We went up to the top floor of that building, this young man Edison and old man Johnson—I am a year older than he is—and we started to talk over the subject and talked all night long, away into the early hours of the morning, and then we separated and went home. I met my associates down the street the next morning and I said: "That chap knows what he is talking about, and he is your man, and he will get you out of the difficulty, and you had better make an arrangement with him," and they made an arrangement with Mr. Edison.

Mr. Edison turned the tables on me and said: "I will take the job if you will allow this fellow Johnson to stop over here a little while and assist me." We went at it. Mr. Edison immediately got to work on the difficulties which confronted the company, and he made improvements after improvements—you know them all—it is not worth while to take your time to tell you about them, but I want to ask you whether or not you are prepared here, as guests at this table, honoring this gentleman, to confirm my judgment that at that time he "knew something."

You have often heard it said that with great minds and great brains goes excessive modesty. I have to thank my young friend on the right here (Mr. Brady) for putting that thought in my mind. This man whom we are honoring tonight is the best exemplification of that statement I have ever seen, and I am sixty-three years of age, and have met a great many people, and I am able to speak of his modesty and its meaning by virtue of the fact that since 1870—can you count? It is a good many years ago—I have had a degree of intimacy with Mr. Edison that I think no man has ever enjoyed other than Charles Batchelor. I give first place to him, but in that intimacy I have learned a great many things about Mr. Edison that was not known to the public, and one is the direct attribute of his modesty, of his character, and that is the great, big, broad heart that he carries within him which he never lets anybody see. I have seen it time and time again, and I had a personal occasion once to feel it myself, and I knew it was there, and I am proud to admit it, and I know now, more than ever, that it was genuine.

Ladies and Gentlemen—I offer you a toast: "Here is to the brain, the greatest brain, in the judgment of great men in Europe" (with whom I have come in personal contact during the fifteen years I have sojourned on that side of the Atlantic, such men as John Lubbock, now Sir Avebury, Sir Richard Webster, the late Chief Justice of Great Britain—not your small inventor, envious of the credit this man receives, but the men without envy, and therefore competent to pass on the work this man has performed); I say, these men united with me in saying that no such brain ever was created in the mind of man as Mr. Edison has shown in the colossal work he has done and the diverse directions which his work has taken. Now, in addition to that brain, I offer you this toast: "Here's to the man with a heart as big as his brain."

F. P. Fish then was called upon and spoke at some length of Mr. Edison's work and his early acquaintance with him. Continuing, Mr. Fish said:

As some of you know, the older of you—for I have been much interested tonight to see twenty, thirty, forty or fifty men that I knew nearly thirty years ago and with whom I had intimate relations for many years—in the old days, beginning with 1882, I was in the rival camp of electric enterprise at a time when things were very small, the business was small, the aspirations were small, the expectations were small. I remember very well, just about that time, hearing one of the most intelligent men in the country, a man who was trained in mechanism, a man whose name was an authority, say: "That man Edison is wasting his time on that form of lamp that he has gotten up; now, there is some sense in the arc lamp that Brush has gotten up, but there is no future whatever for this dream of Edison's." The business in those days was not only small, materially, but it was small in some other ways. There were all kinds of jealousies, a good many of them on the side of some of my friends who were associated with Mr. Edison—never, in one single instance, as far as I ever heard, on the part of Mr. Elison himself; do not forget that, for from the very beginning he never showed one single particle of that small, petty meanness and jealousy which was in the business.

The time came when we got together, and there was no reason under the sun why it should have taken years for Mr. Edison and myself to have gotten into these relations which I wanted—which he could not have wanted, particularly, because there was no reason why he should—but I wanted them personally, and I wanted them in the interest of the business for which I was working, which was the General Electric Company, and to my surprise I had not seen Mr. Edison for one hour before I found out that he was one of the largest, broadest, clear-minded and fairest business men in the situation, which, as Mr. Insull says, was extremely delicate, as can be imagined by anyone with the most vivid imagination, and from almost our first interview down to the time when, to my very great regret, I began to see less and less of him, he was the same.

Mr. Insull then said: "I do not think this occasion would be complete unless we heard from Dr. Steinmetz."

DR. C. P. STEINMETZ'S ADDRESS.

It is a momentous occasion which has brought us together tonight to celebrate the existence of our association for one lifetime, and it is a lifetime ago that the grand master of our industry in-

vented the incandescent lamp, whom we have the pleasure and honor of having with us tonight, as a member of our association. Mr. Edison thirty years ago invented the incandescent lamp and thereby created the possibility of our association's existence since that time.

Now, when Mr. Edison gave us the incandescent lamp, it was an invention more complete than any invention which ever has been made. It is interesting to realize that for a quarter of a century all the engineering and scientific talent and ability of the entire world has not been able to advance the incandescent lamp by one single radical feature, beyond the position where the inventor left it. All the advance has been made in methods of manufacture, and it took a quarter of a century for the electrical industry to develop new and unknown methods, electric furnaces, for the chemistry to advance, to make available to us materials non-existent in the early days, which were necessary to advance the incandescent light a single radical step, and even now, if we speak of the high efficiency of the tungsten lamp, do not forget that tungsten melts and boils at a temperature where carbon is still solid, and that the carbon filament lamp may still outrun the tungsten lamp in efficiency. There are the potent possibilities. The electrical industry has advanced since those days, in that lifetime, at an enormous rate, from the small dynamos of Edison's first station to the huge generating system of our friend from Chicago, Mr. Insull, where at least momentary power is available at the bus bars, measured by many millions of horsepower, an amount of power equal to the concentrated power of Niagara. That is, if you look at the advance of electrical industry from Edison's dynamo to the new dynamo station of the Commonwealth Edison Company of Chicago, or other large companies, what have we done? We have taken the commutator from the dynamo and put it two, ten or twenty or fifty miles away, and it still revolves with the armature of the dynamo synchronously, and we call it a rotary converter; that is, we have lengthened the commutating leads and connections between the commutator and armature from a few inches to many miles, but it is the same system and is not radically changed; it is a development of the old dynamo of Menlo Park, which still now generates and distributes the power of our huge modern systems.

It is not the great work of the creation of the incandescent lamp, or the creation of the generating system, which we desire to honor in our grand master—we do him honor because he created the electrical industry. There had been dynamos before his time, there had been scientific toys, apparatus suitable for physical demonstration, for exhibition purposes, for fancy, spectacular lighting, but it was Edison who insisted that the dynamo must be on the engine shaft, who has converted the physical apparatus into a machine, converted and changed electrical engineering from a branch of physical science into an industry, and all of these millions of dollars which are now invested in the electrical industry are invested in a thing which has been created by our grand master.

No theoretical man could have ever done that, no practical man could ever have done that. Only yesterday I heard the old stale joke sprung on theory and practice. Now, I do not recognize Mr. Edison as a theoretical man. I do not recognize him as a practical man. There are three ways of proceeding—the one is that of the practical man, who tries everything, and something else, and then fails, as a rule, because the number of possibilities is so unlimited that it is only luck that he may strike success once, and that never happens twice in a lifetime. The theoretical man proceeds still differently—he systematically starts from truths and premises, building up conclusions by mathematical formulas, and also scientifically proving methods, reaching conclusions which are correct scientifically, and in every other respect right, although numerically, if he does not happen to mistake a decimal point or two, his correct results apply to phantom phenomenon in a phantom world, but not to real things in a real world, except that a master mind directs in the selection of his premises, directs him in the use of his conclusions, so that after all the work of the theoretical man and the practical man are merely details of the master mind. Now, the third method is the method by which all the great advances of the world have been accomplished, by very few men, is being accomplished and will be accomplished—has been accomplished by men such as Faraday, Helmholtz, Edison—they proceed, not by the approved methods of science, but they pass beyond all these cumbersome mathematical and theoretical investigations, they lead the course by intuition, starting from the premises, leading to the results in a single step, in place of the numerous mechanical work across intermediate formulas and equations, which have no meaning by themselves. The theoretical man may then be called upon to calculate the second or third decimal. The result is there already.

Practically, also, investigations may be made, hundreds of experiments may be tried, more or less successfully, but it is not the blind trials of the practical man, but the reasoning direct, and that other quality which we may call common sense, because it is so extremely uncommon, which produces the result.

Now, it is true that all the advance of the world has taken place because of the efforts of those men who have been above theory and above practice, and therefore I say, I cannot recognize Mr. Edison as a theoretical man or as a practical man, but as one of those few for whom the differences between theory and practice have disappeared, just as the differences of the east and west cease to appear at the poles of the earth.

And, therefore, I ask you, gentlemen, and you, ladies, also, to drink to the health of Mr. Edison, the genius, and express our hope that for many years to come he may assist us with his help, and his advice, and with the stimulation of his work.

Mr. Insull said that before handing over the gavel to the president of the association and ending his part in these very pleasant exercises, he thought that the staff of the New York Edison Company was entitled to a vote of thanks for the very successful work which they had done in decorating the dining room. The transformation that had been effected here in less than twenty-four hours was marvelous, and he knew that all of those around the table who were engaged in practical electric-lighting work must be lost in admiration of the work which had been done, its finished and wonderfully artistic effect. Their work had been a work of love, they had taken as much interest in it as those present had taken in this occasion.

President Freeman then said that the only feature of the programme which was not entirely delightful to him was now due, and that was in the renunciation of all honors of this kind in future to a better man, who had been elected to the presidency of the association. We all recognize the necessity of frequent changes in office, if occasions of this kind are to be repeated, and he was certain that it would take the retiring president a considerable time to get down to a normal state of mind, and any danger of a repetition of the occasion would be altogether alarming. He called upon Thomas E. Murray, the newly elected president, and courteously asked him to accept a place at the head of the table and preside over the further functions of the occasion.

Mr. Murray expressed his hearty thanks for and sincere appreciation of the honor conferred upon him in electing him to the presidency of the association. It would be the object of his best endeavors to maintain the high standard of the Edison association, and in furthering the interests of the individual member companies. He expressed the cordial thanks of the association, and its guests, to Mr. and Mrs. Edison for honoring them with their presence.

THE GUESTS.

Among those seated at the great center table were:

Mr. and Mrs. Thomas A. Edison, Charles Edison, Madelaine Edison, Master Theodore Edison, Mr. and Mrs. W. W. Freeman, Mr. and Mrs. W. S. Andrews, S. Bergman, Jr., W. S. Howell, C. P. Dyer, P. J. Kreusi, J. W. Howell, W. J. Hammer, Charles W. Price, Gen. George H. Harries, C. R. Huntley, Mr. and Mrs. Alex Dow, Mr. and Mrs. Greenfield, Frank Frueauff, T. C. Martin, Mr. and Mrs. J. B. McCall, E. R. Weeks, S. S. Wheeler, R. T. Lozier, L. B. Stillwell, Arthur Williams, E. B. Gilmore, E. A. Baily, J. H. Vail, Dr. C. P. Steinmetz, Mr. and Mrs. Samuel Insull, Mr. and Mrs. J. W. Lieb, Mr. and Mrs. T. E. Murray, Mr. and Mrs. C. L. Edgar, N. F. Brady, Mr. and Mrs. E. H. Johnson, Mr. and Mrs. F. A. Vanderlip, F. P. Fish, Mr. and Mrs. J. T. Lovejoy, Mr. and Mrs. Louis Ferguson, B. E. Sunny, George B. Cortelyou, H. M. Byllesby, F. J. Sprague, Mr. and Mrs. E. W. Burdette, Mr. and Mrs. Walter R. Addicks, W. H. Meadowcroft.

At other tables were: Mr. and Mrs. C. D. Haskins, H. A. Wagner, Charles Blizard, W. S. Barstow, Fred C. Bates, E. H. Davis, W. L. R. Emmet, Frank H. Gale, John F. Gilchrist, Converse D. Marsh, A. D. Page, A. L. Rohrer, M. S. Seelman, Jr., Clayton H. Sharp, Francis W. Wilcox, John Wolff, William Yeager.

Among the presidents of prominent electrical associations, who were present to do honor to Mr. Edison, were the following-named gentlemen:

Thomas E. Murray, New York, of the Association of Edison Illuminating Companies.

Frank W. Frueauff, Denver, of the National Electric Light Association.

Lewis B. Stillwell, of the American Institute of Electrical Engineers.

Theodore Beran, of the New York Electrical Society.

The Timber Supply of the United States.

The Forest Service of the United States Department of Agriculture has prepared, in the form of a twenty-four-page circular, a preliminary report on the timber supply of the United States.

The object of this circular is to answer, so far as present knowledge permits, many questions which are constantly arising concerning the extent of our forest resources, their ownership, the rate at which they are being cut, and the outlook for a future timber supply. The data given have been drawn from every available source.

The original forests of the United States exceeded in the quantity and variety of their timber the forests of any other region of similar size on the globe.

It is safe to estimate that the original forests of the United States covered 850 million acres and contained 5,200 billion board feet of saw timber according to present standards of utilization. In addition, there were probably 100 million acres of scrubby forest and brush land, chiefly in the West, which has been and still is a source of much post and fuel material.

The original forests of the United States have been reduced by cutting, clearing, and fire from an acreage of 850 million to one of not more than 550 million, with a total stand of some 2,500 billion board feet.

Of the total land area, the original forest area was forty-five per cent, and the present forest area is twenty-nine per cent. Of the original forest area the present forests cover sixty-five per cent. The present forest comprises about forty-eight per cent of the original stand of timber.

Most of the forests in the United States are privately owned. Approximately twenty per cent of the standing timber in the country is held by the Federal Government in national forests, Indian reservations, national parks, and on the unreserved public domain, and by the states in state reserves or other state lands. These public forests contain more than 100 million acres of saw timber.

The private forests are of two distinct classes, (1) farmers' woodlots and (2) large holdings, either individual or corporate. The farmers' woodlots are chiefly scattered and detached remnants of the original forests, which, as a rule, have been severely culled. They are mainly in the eastern half of the United States, and cover some 200 million acres, with a stand of perhaps 300 billion board feet of saw timber and one-and-one-half billion cords of wood. Aside from their protective and ornamental value, they furnish much firewood, many posts, poles, and cross-ties, and some lumber and cooperage stock.

The larger private holdings contain about 1,700 billion feet. These holdings generally include the best timber in the regions in which they occur, since private capital always seeks the best possible investment. They are the principal sources of the lumber which is used today, and upon the manner in which they are managed depends in a large degree the timber supply of the future.

So far, true forestry has been practiced to only a slight extent, or not at all, upon the forests in private hands, and, because of lack of funds, it has not yet been possible to apply right methods of forest management to all public forests, though such methods will eventually be used in handling them.

The value of the forest products of the United States in 1907, the last year for which detailed data are available, was approximately $1,280,000,000. The poles, posts and rails used for fences and overhead electrical circuits were valued at $100,000,000.

Some three-and-one-half million round poles exceeding twenty feet in length are used annually by telegraph, telephone, and other electric companies. Over three-fifths of these poles are cedar, and more than one-fourth of them chestnut. Relatively small amounts of pine, cypress, and redwood poles are also used.

The total yearly drain upon our forests, not counting losses from fire, storms, and insects, is some twenty billion cubic feet. Our present forest area of 550 million acres may be roughly estimated to consist of 200 million acres of mature forests, in which the annual growth is balanced by death and decay, of 250 million acres partially cut or burned over, on which, with reasonable care, there is sufficient young growth to produce in the course of time a merchantable, but not a full crop of timber, and 100 million acres of more severely cut and burned-over forests, on which there is not sufficient young growth to produce another crop of much value.

Taken as a whole, the annual growth of our forests under these conditions does not exceed twelve cubic feet per acre, a total of less than seven billion cubic feet. That is, we are cutting our forests three times as fast as they are growing. There is menace in the continuance of such conditions. While we might never reach absolute timber exhaustion, the unrestricted exploitation of our forests in the past has already had serious effects, and it will have much worse if it is allowed to continue unchecked. White pine, for instance, which was once considered inexhaustible, has fallen off seventy per cent in cut since 1890, and more than forty-five per cent since 1900. The cut of oak, our most valuable hardwood lumber, has decreased sixteen per cent since 1900, and that of yellow poplar twenty-two per cent. The same story will be told of other woods if they are not conserved.

The fact that timber has been cheap and abundant has made us careless of its production and reckless in its use. We take 250 cubic feet of wood per capita annually from our forests, while Germany uses only thirty-seven cubic feet, and France but twenty-five. On the other hand, Germany, who has learned her lesson, makes her state forests produce an average of forty-eight cubic feet of wood per acre. We have as fast-growing species as Germany, or faster, and as good or better forest soil, if we protect it.

The necessity for more farm land may eventually reduce our total forest area to 100 million acres less than it is at present. It is entirely possible, however, to produce on 450 million acres as much wood as a population much greater than we have now will really need if all the forest land is brought to its highest producing capacity and if the product is economically and completely utilized. But to reach the necessary condition of equilibrium between timber production and consumption will take many years of vigorous effort by individual forest owners, by the states, and by the national government. None of them can solve the problem alone; all must work together.

Pay-Within Cars.

A new type of trolley car will shortly be put into use in Bayonne, N. Y., by the Public Service Corporation of New Jersey. The cars are to be called pay-within cars. Both front and rear doors will be controlled by the motorman and platforms will be eliminated. The passenger will step from the street into the car proper. He can only leave by way of the front door, and there are no handles on the cars for persons to grasp in getting on or off. The doors will not open until the car comes to a full stop. It is believed that this design will reduce accidents to a minimum.

The American Mining Congress.

The twelfth annual session of the American Mining Congress will be held at Goldfield, Nev., from September 27 to October 2 next, inclusive.

The meeting will be of particular interest to electrical men on account of one of the subjects to be taken up at this meeting being "The Standardization of Electrical Equipment in Mining Work."

This was proposed at the Pittsburg (Pa.) meeting last December by David B. Rushmore, of the General Electric Company, Schenectady, N. Y., and as a result of his recommendation the following gentlemen were appointed a committee to consider this important question: Dr. Edward B. Rosa, Bureau of Standards, Washington, D. C. (chairman); David B. Rushmore, General Electric Company, Schenectady, N. Y. (representing the electrical manufacturers); W. A. Thomas, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. (also representing the manufacturers); J. R. Bent, Oglesby Coal Company, Oglesby, Ill. (representing the mine operators); George R. Wood, Pittsburg Coal Company, Pittsburg, Pa. (also representing the mine operators); T. L. Lewis, president of the United Mine Workers of America (representing labor); and James O'Connell, vice-president of the American Federation of Labor, Washington, D. C. (also representing labor).

While the committee has been so recently organized that not a great deal of work has thus far been accomplished, it will render a preliminary report at the coming Goldfield congress announced above. It will then continue its work, and within the next few months it will doubtless be prepared to complete its recommendations in this timely and important matter.

The absence of uniformity in the installation of electrical equipment in coal and precious-metal mines has given rise to problems very annoying to operators and even to manufacturers, and the work of this committee will be watched with interest.

Those having any views to offer on this subject are invited to send them to Dr. Edward B. Rosa, Chairman of the Committee, care of the Bureau of Standards, Washington, D. C.

Consul-General Thomas Sammons, of Seoul, states that on March 31, 1909, there were 172 telegraph and eighty-five telephone offices in Korea.

Action Against Canadian Hydroelectric Commission.

Defeated in their attacks on contracts entered upon by the Hydro-Electric Commission of the province of Ontario with the various industrial municipalities of Ontario, the electrical interests have found another point which in their opinion offers better chances of success in their campaign to defeat the power policy of the Ontario Government.

According to a writ issued at Osgoode Hall last week their efforts are now concentrated upon annulling the contract entered into by the commission with the Ontario Power Company for the supply of electrical energy. The ground taken is that the company is assuming to take water from a navigable river forming part of the boundary between the United States and Canada, and under the authority of the Government of the Dominion of Canada, without the sanction of such Government.

The writ was issued by Messrs. Beatty, Blackstock, Fasken and Chadwick, for John A. Murray, on behalf of himself and all other ratepayers of Toronto, against the Hydro-Electric Commission.

In all previous cases the defendants have been the municipalities concerned, and efforts by the latter to have the commission joined as co-defendants were resisted.

In the present case the plaintiff asks the courts to restrain the Hydro-Electric Commission from erecting transmission lines and transformer houses and other electrical appliances for the transmission of electrical energy generated by the Ontario Power Company from the Niagara River, and from proceeding with the acquisition of real estate or easements for the location of such lines, and from proceeding to spend the money and pledge the credit of the Province of Ontario and the municipality of Toronto in carrying out the contract pretended to have been made by the defendants with the Ontario Power Company for the purchase of power generated from the Niagara River.

Suit Against United Railways.

J. Brooks Johnson has filed suit against the United Railways Company, of St. Louis, and the St. Louis Transit Company to recover about $35,000 in judgments against the St. Louis Transit Company, and asks for the appointment of a receiver, alleging fraud in the transfer of the Transit company's assets to the United Railways Company.

Receiver for Juniata Water and Power Company.

A bill in equity has been filed in Common Pleas Court No. 1, at Philadelphia, for a receiver for the Juniata Water and Power Company. The company defaulted on its first mortage five per cent bonds last May, and the present suit is the result of that and differences as to the management and reorganization of the company.

The capital stock outstanding is $7,500,000, and there is a debt of the same consisting of first mortgage five per cent bonds. A second mortgage of $500,000 is authorized but not issued.

Receiver Asked for Deschutes Irrigation and Power Company, of Oregon.

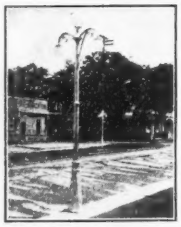
Application for the appointment of a receiver for the Deschutes Irrigation and Power Company was made September 1 in a suit filed by John G. Deshler, of Columbus, Ohio, against that company in the United States Court. Conspiracy, mismanagement and breach of trust are charged against the directors of the company, which is alleged to be in arrears for the last three semi-annual interest payments on a bonded indebtedness of $359,000. With the exception of 20,000 the entire bond issue is owned by capitalists of Columbus. The irrigation company has contracted to reclaim about 250,000 acres in eastern Oregon. About one-fourth of the area has been placed under irrigation up to the present.

Trolley Freight in Pennsylvania.

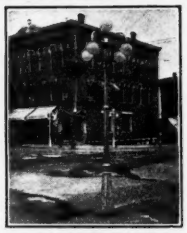
The Philadelphia Rapid Transit Company, taking advantage of the act passed by the recent Legislature relative to trolley companies carrying freight, has begun the running of cars between Doylestown and Philadelphia, a distance of about eighteen miles.

This company is erecting a station at Warrington, and a similar building is to be erected at Edison. The Transit Company proposes to haul any kind of freight that its cars will carry.

The movement for a union terminal for the three roads, the Rapid Transit, the Philadelphia & Easton and the Bucks County Electric Railway Companies, is again being agitated, and it is said that in a short time operations will be started for the building of the terminal. This building would be used for the housing of the cars of the three companies over night in order that all runs may be started direct from this point.



ELECTRIC LIGHTING and ILLUMINATING ENGINEERING



THE PROBLEM OF DOMESTIC LIGHTING.

BY DR. LOUIS BELL.

House lighting, despite its intimate relation to the life of people at large, is upon the whole the most neglected branch of artificial illumination. One would suppose that, considering the fact that a man has to pay lighting bills all his days, he would make every effort to get his money's worth and would go to some trouble to obtain the best possible results. In fact, however, the average man merely confines his efforts at betterment to kicking about the quality of the light and protesting at the amount of the bills, while the average woman, who is the more important factor of the domestic situation, adds to the grumbling chorus some items to the effect that any form of lighting specified by mere man is hopelessly inartistic. As a result house lighting is too often inefficient, expensive and garish.

To begin with, when a house is being planned the matter of lighting is commonly left to the very end of the chapter. The architect's draftsman crosses in a few outlets in conventional positions and no further attention is given to the matter until the building is so near completion that contracts for piping and wiring must be let at once. As a first suggestion for improvement, the architect's estimates and plans ought to cover all the provisions for lighting and heating the structure which are not of a strictly portable nature. It is absurd for a self-respecting architect to devote keen attention to decorative detail in his designs and estimates and then disclaim all responsibility for the lighting fixtures and permit the glib-tongued fixture salesman to unload upon his victim miscellaneous brasswork at two dollars the pound. Fixtures are as much a permanent part of the decorative scheme of a house as is the ornamentation around the mantels. The practical effect of leaving fixtures out of the architect's estimates is that they are dropped out of sight until it is too late to make a proper allotment of funds for them, and far too late to rearrange the outlets, which ought to be the subject of very close attention.

There is, too, an altogether bad tendency to provide outlets on the theory that combination fixtures are going to be used, with the result that the location and arrangements are those which are suitable for gas and all the advantage of facility which really characterizes electric lighting is lost. The expense is largely increased by combination systems and for all practical purposes the gain in reliability or in convenience is negligible. At the present time neither gas nor electricity is out of service enough to amount to anything, and if either does fail it is for so short a time that lamps, or, still better, candles, tide over the emergency very easily. And combination fixtures are peculiarly undesirable when purchased with undue economy, since, while cheap electric fixtures may be bad, cheap gas fixtures are positively dangerous, and cheap combinations still worse. In a modern house located in a territory where electric service is available, gas piping has no use beyond the kitchen. If only gas is available, a thoroughly good job of illumination can be done with it, and there is no use in wiring for combination fixtures even then, for when electric service is available the wiring scheme should not be confined to locations suitable for gas lights.

Very much mischief is done in house lighting by the lack of attention to which reference has been made, but even more is done by ignorance and prejudice on the part of the householder. The fear of electric wiring has not been altogether eliminated from womankind in particular, neither has the idea that electric light is "inartistic," "unbecoming," "bad for the eyes," etc., notions carefully fostered by the gas man, and due originally to the utter lack of knowledge of the first rudiments of proper illumination. And then comes the fixture salesman and gets busy at selling either for gas or electricity, anything that he can unload at sufficient price. For instance, the writer has in mind a popular style of chandelier and shade, that probably cuts off not less than three-fourths of the useful light without at all improving its quality or distribution; also a fixture designed for a piano lamp, which, from the standpoint of giving light, is altogether inferior to what one could extemporize from an old tomato-can. The result of such abominations is that an inordinate amount of light has to be used, the bills run up, and there rises the familiar complaint, that electric lighting costs outrageously much. Gas fixtures are sometimes bad enough, but the necessity for ventilation and avoidance of overheating combine to prevent results quite so bad as when the artistic temperament gets busy with an electric fixture.

Now, from a practical standpoint, the fundamental question in domestic lighting is how good results can be obtained at reasonable expense. It is altogether a fallacy to suppose that electric lighting is in itself particularly expensive, even at the relatively high rates commonly charged the small consumer. Some years ago the writer, living in a suburban house where neither gas nor electricity was available, took careful reckoning as to the cost of lighting by kerosene, the oil being purchased by the barrel and a locked faucet applied to check against waste. Without going into details, the result was that the house could have been lighted by electricity at practically the same cost, assuming the price of twenty cents per kilowatt-hour then charged on the nearest circuit. Of course, at such a price the cost per theoretical candlepower-hour was greatly in favor of the oil, but the total actual cost for the house is not measured by this figure, but depends on the relative waste of light by the two methods.

Electricity is the one artificial illuminant which can conveniently be used only when it is needed, and it is the proper appreciation of this fact that determines the economy of domestic lighting. The

vital question is, how many candlepower-hours are needed for the proper service of the household? All light in excess of this is, from the economic standpoint, wasted. In using oil, candles or gas, it is not practically convenient to turn out the light in a room where temporarily unoccupied, and while gas may be easily turned down, it frequently is not, from the mere inconvenience of reaching for the fixture. Hence there is steady waste, often amounting to much more than the light actually utilized.

Of course, one can fall back upon electric gas-lighters, which can be operated like an electric switch at any convenient point, and in theory these can give to gas the same convenience in turning out possessed by electric lights. As a matter of practice, however (and the writer here speaks from considerable personal experience), the electric gas-lighting appliances as installed for house use are troublesome and frequently out of order. In addition, the full automatic form, which is the only one at all comparable with a switched electric lamp, may be and often is dangerous, both from accidental failure in operation and from being the source of small persistent leaks of which the final results may be grave, especially with gas rich in carbon monoxide.

The key to economical lighting is to control the lights by conveniently placed switches, so that they can be, and naturally will be, turned out when not in use. To this end it is wise to avoid key sockets as far as possible, save for table lamps and the like, to provide automatic door switches for closet lamps and in general to plan the lighting for the purposes of its use. Money spent in a thorough switching system is recouped very quickly in reduction of bills.

Another thing always to be borne in mind is the adjustment of lights to their requirements. In many places a four-candlepower lamp is just as good for practical purposes as a sixteen-candlepower, and a well-placed twenty-five-watt tungsten lamp is quite as effective as a badly placed 100-watt carbon lamp. The advent of the tungsten lamp enables domestic lighting to be done with a degree of economy hitherto quite impossible.

As to the placing of lamps, perhaps the commonest fault is the use of fixtures in which the axis of the lamp is at an angle. So far as the lamp itself is concerned such a position is unobjectionable, but bare high-efficiency lamps should never be used under ordinary circumstances, and there are no shades capable of giving first-class distribution in an angle fixture. A lamp should be placed tip down or tip up, and it can then be so shaded as to give almost any distribution required. The tip-down position is generally preferable, as suitable shading is thereby made easier. Only in the case of groups of lamps is good total distribution from an angle fixture really practicable, and groups are ordinarily less economical than well-placed single lamps of equivalent power.

The most economical general method of illumination for domestic purposes is a moderate diffused illumination reinforced where necessary by reading lamps or other localized light. As a rule the effect of this arrangeemnt is pleasanter and easier for the eyes than a purely general illumination, except in large rooms, which require to be brilliantly lighted. In fact, rooms in very dark finish are extremely hard to illuminate properly except by the device just noted, since proper diffusion is hard to obtain. A very light ceiling improves matters, but too often at the expense of a certain glaring effect that is better avoided.

With careful arrangement of lights and switches, domestic lighting can be done very economically. There are few rooms that cannot be given an adequate groundwork of illumination with tungsten lamps on a basis of a quarter watt per square foot of floor space. An equal amount in localized light is generally sufficient for additional lighting. At any moderate price for energy this means cheap illumination, considering the fact that very few rooms are used simultaneously in the ordinary house, and of these only a part require more than the groundwork lighting. Very often one would provide for double the amount of energy consumption just noted without using it save on rare occasions.

At the present time much is being done to exploit electric fans and electric heating and cooking appliances. Sufficient outlets should be provided in the house wiring to allow for these conveniences. It must be admitted, however, that save in some exceptional localities they run up the bills rather seriously. Central-station policy has usually been very unfavorable as regards the consumption of energy for domestic purposes. It is, of course, true that the householder is a small consumer with a rather large connected load, and on most schemes of charging he consequently gets bad rates, much worse than in the writer's opinion he ought to have. For the domestic load on the whole falls off the ordinary peak, and while an individual demand may occasionally be large, as when the house is lighted for a reception, such demand does not come simultaneously from any considerable number of consumers, and it practically always comes later than the peak. Experience shows that an absurdly large nominal house load can be taken care of by a very moderate transformer and feeder equipment. In fact, the domestic consumer is, from the nature and period of his load, entitled to much more consideration than he ordinarily gets. A recent English investigator, bearing this in mind, came to the conclusion that domestic lighting was in equity entitled to a better rate than the consumer in the small shop or office. Such has not been the common judgment here, yet the few plants that have conspicuously encouraged the domestic use of electricity have in effect endorsed the English opinion. Certainly the gas companies, who operate on a nearly flat rate, have found house lighting a profitable field—perhaps the most profitable left them—and have gone out of their way to occupy it. The gas range has helped them greatly in this campaign, while electric cooking has been much hindered in its development by the charging systems in vogue among electric companies.

There are signs of reform in this matter, however. A few electric companies, both here and abroad, have reverted to a flat charge per lamp or have taken similar steps to get domestic business. The flat charge is not to be commended in that it punishes that liberal installation of lamps that generally is desirable in a house. But certainly reasonable concessions to the householder, such as have been made in some places, will result in increased consumption on a profitable basis, and, what is equally important to public-service corporations, in an increase in the number of friends ready to stand by them.

Electric Meter Tests.

New York Public Service Commissioner Maltbie adjourned the electric-meter-test hearing that was scheduled for August 30 until September 13. At that date the Commission will determine whether, in order to insure the reporting of all tests of electric meters according to a standard form of report, every electric corporation operating within the First District shall be required to file a monthly report with the Commission stating the results of all such tests.

COMMERCIAL TESTS ON SYSTEMS OF ILLUMINATION.

BY A. L. EUSTICE.

In modern illumination practice, when a lighting company or large individual consumer contemplates the installation of a lighting system which involves the expenditure of a large sum, the tendency of the present time is to make an investigation of the various systems of illumination now offered to the public in order to determine which system is best suited to the specific requirements.

The object of such an investigation is primarily the determination of comparative figures of total operating costs on the basis of equality of illumination, for it is important and essential to determine the relative actual working efficiencies of the various systems which will provide a fixed standard of mean illumination and not to arrive at conclusions as the result of comparisons of the recognized laboratory efficiencies of the individual sources of light, because the working efficiency of a system does not necessarily depend entirely upon the laboratory efficiency of the type of unit employed.[1]

In investigating the total cost of operating lighting systems, in order to determine which system has the lowest cost of operation, the following factors should be considered:

1. Commercial efficiency or cost of current consumed.
2. Cost of renewals or maintenance (labor and materials).
3. First cost or investment.

Investment is the least important of the items named, because any justified difference in the first cost of the various systems is based on the relative total cost of energy consumed and maintenance.

The ultimate decision, therefore, on the basis of equality of illumination, depends upon the observed value of mean illumination delivered by the systems in question, as determined by commercial tests on the systems when operating under actual service conditions of regulation, maintenance and surroundings under which the system is to be installed and operated, so that it is at once evident that the value and accuracy of the final comparative figures depend chiefly upon the test methods employed and the attention given to details and accuracy in the commercial illumination tests.

For a subject of such general interest and wide application, it is surprising to note the many erroneous test methods employed by some illuminating engineers and representatives of manufacturing companies for the determination of mean illumination. An examination of such methods will often show the resultant great number of unfair and inaccurate comparisons frequently given to the lamp buyer and technical public. A brief review of test methods is opened, therefore, in order that emphasis may be given, in the most forcible manner, to the importance of employing correct methods when conducting fundamental tests.

Tests on actual installations of various equipments should be carefully planned and executed after having firmly established the true meaning of the words "mean" and "average" illumination. The common errors often present in illumination tests are:

1. Improper selection of number as well as location of test stations.
2. Selection of test bays where the general nature and color of surroundings differ.
3. Disregard for actual operating voltage when other than normal.
4. The use of electrical measuring instruments whose calibration is not known.
5. Employment of units whose efficiency and energy consumption are not normal.

Perhaps the most common source of error in tests of this character is the general lack of judgment in the selection of both number and location of the test stations, so the following method of preparation for tests is recommended for giving a resultant true mean illumination.

In order to do entire justice to the various types of units under consideration, the location of the test area or bay should be chosen in every case without reference to the condition of the light sources except to note that every outlet within the effective range of the test bay contains no burnouts. To secure a typical result, the bay selected for test purposes should be entirely surrounded by other bays, so that the true effect of distant lights can be secured.

The test bay or area between the four columns should be divided into a great number of equal small areas, which are in turn considered as sub-test areas. At the center of each small test area there should be located a test station, where the illumination is determined by means of a carefully calibrated foot-candle photometer (illuminometer), as shown in Fig. 1. The illumination thus determined at each station represents the mean illumination of each sub-test area, and the arithmetical mean of the various values at the total number of test stations in the bay is a very close approximation to the mean illumination of the bay and of the system.

Where the surrounding reflecting surfaces, such as shelving, furniture and displays, are uniform in color and placement, and the ceiling is light in color, and when the lighting system has a uniform spacing and size of unit, the test area may be reduced to one-quarter of the total area of the bay. It is, however, better practice to increase the labor rather than to sacrifice accuracy in the results.

At each test station, no less than four separate observations of illumination should be made, and the mean of the readings taken as the illumination of that area. Simultaneous readings of voltage should be recorded with each observation of illumination and due corrections made according to the voltage-candlepower characteristics of the units in question, when the operating voltage is other than rated voltage.

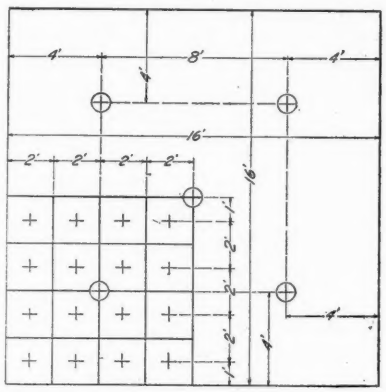


FIG. 1.—CORRECT LOCATION OF TEST STATIONS.

The surprising differences in results which it is possible to secure can be appreciated only by contrasting the figures obtained by the above-outlined method, with the results of the erroneous methods sometimes used, of which the following review of some recently conducted commercial tests will serve as a practical illustration:

In the commercial test in question, the unit area, commonly termed the bay, or the area enclosed between the four columns, was approximately 256 square feet (sixteen by sixteen), in which the predetermined location of outlets provided for five light units of which four outlets per bay were arranged symmetrically in rows in either direction, with the fifth outlet located in the center of the bay. With

[1] See article by the writer in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 29, 1909, page 992.

these restrictions regarding outlets, two systems of illumination were under consideration.

The one system (A) was based on a unit that actually had a very full or broad distribution curve, which tends to produce a very uniform distribution of illumination, while the other (B), though claimed to have a broad distribution, was equipped with a very concentrating type of prismatic reflector, with the resultant non-uniform intensity or "spotty" illumination.

The location of stations was absurd, as shown in Fig. 2. From this it is at once apparent that five of the eight stations were directly below a unit, and hence a unit with a concentrating curve should show a result—where the majority of stations are so situated—greater by far than that obtained from the unit having a broad curve; whereas, under proper methods, the result should be reversed.

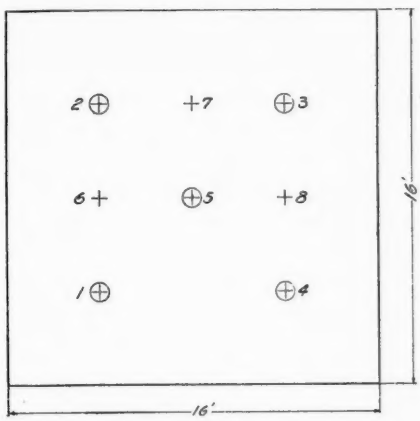


Fig. 2.

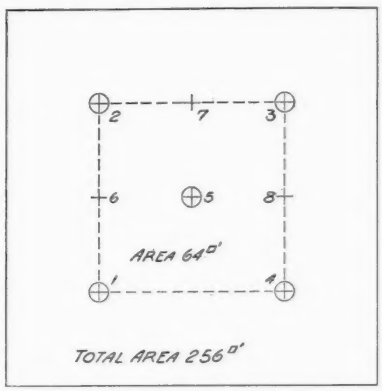


Fig. 3.

INCORRECT LOCATION OF TEST STATIONS.

The cause of such a reversal of figures is self-evident to anyone who is broad enough to see the evidence presented by a glance (Fig. 3) at the relation existing between the area covered by the test stations and the entire area of the bay. It will be seen that test stations were confined to approximately one-quarter of the area in question, yet in the report of the engineer in charge, the mere average of the values found at the eight stations was considered a true average for the entire area.

It is well recognized that an appreciable flux of light from each unit falls on the working plane in the area included between the limits of the bay and the area covered by the above-named selection of test stations, and it will require no lengthy argument to convince those who are anxious to do justice to the various forms of light, that the unit with a natural broad distribution curve will show a superior illumination in both quantity and distribution over the entire bay.

An analysis of the foregoing evidence and of the following figures (Table 1), taken from the above-mentioned report, would doubtless prove to the satisfaction of anyone, the absolute necessity of care in planning the layout as well as executing all tests of this character; not only as a matter of justice and right to the manufacturer, but also as a matter of information to the purchaser of illuminating devices.

TABLE NO. 1.

System A.

Combination.	Mean Illumination.	Per Cent of Variation, Maximum.	Minimum.
No. 1.....	4.13	12.0	9.5
No. 2.....	3.11	6.3	8.1
No. 3.....	2.68	26.8	15.6

System B.

Combination.	Mean Illumination.	Per Cent of Variation, Maximum.	Minimum.
No. 1.....	3.64	26.0	12.0
No. 2.....	2.65	28.3	12.0
No. 3.....	2.94	39.1	28.0

System A employed units whose distribution is broad.
System B employed units whose distribution is concentrated.
Combination 1—Entire room in operation—5 units per bay.
Combination 2—Entire room in operation—4 units per bay.
Combination 3—One bay only in operation—5 units per day.

In general, the prominent features of the above figures are shown by the percentage variation of the maximum and minimum intensities from the so-called mean value; the greater variation being from system B and the peculiar manner in change of value of the "mean" of the various combinations.

The increase in illumination or the accumulative effect of the surrounding and distant units, even under such an adverse selection of stations, will be observed in combinations 1 and 2 of system A, and it is interesting to note that combination 3 alone, due to the use of concentrating reflectors as well as to selection of stations, would lead one to believe erroneously that system B is the more desirable system, in so far as intensity is concerned.

Referring to this subject as discussed in the report, the extract given below will give further evidence of the effect of selection of stations, but it must be borne in mind that of the series of tests on eight combinations of each system (combinations of glassware) only two were such that the effect of distant lights was considered, and great stress was laid on the value secured when one bay only was in operation. In fact, the final figures were based on the result of one bay only.

In system A the report states: "The effect of lamps outside each bay is to increase the illumination about fifty-five per cent and to reduce the variation in illumination."

In system B—"The effect of distant lights is to increase the illumination about twenty-four per cent and to reduce the variation in illumination."

In order to arrive at some definite figures, a test installation was arranged to duplicate the conditions of the commercial installation (as shown in Fig. 2) and a series of tests was conducted under the direction of the writer, according to the above-advised location of test stations (Fig. 1), and, further, when the systems were operating with constant normal potential over the lamp terminals at all times, so that the errors due to voltage corrections were entirely eliminated.

TABLE NO. 2.

	Mean Illumination. Entire Room in Operation, Units per Bay,		One Bay Only in Operation, Units per Bay,	
System.	Five.	Four.	Five.	Four.
A....	5.94	4.36	3.05	2.29
B....	5.16	4.01	3.48	2.69

The results of these tests (Table 2) show the true mean illumination delivered by the two systems in question in a large general office, where both four and five units were in service in each bay, as well as the mean illumination from one bay only, from which the true relative increase in illumination, or the accumulative effect from the surrounding bays, is apparent for both systems.

It will be noted that the increase in mean illumination by the addition of the center unit to the four-unit combination per bay, when the entire room is in operation, does not differ to any great extent for each system, and it is increased almost in proportion to the increased wattage, whereas the relative increase in illumination of a bay, when operated singly, and with the entire installation, is greater by far in the case of system A.

The per cent increase in illumination for the various combination can be compared by a glance at the following data:

TABLE NO. 3.
Per Cent Increased Illumination.
One Bay Only to Entire Room.

System.	Correct Method (Fig. 1). Five Units.	Four Units.	Incorrect Method (Fig. 2). Four Units.
A.....	94.75	90.4	55.0
B.....	48.27	49.07	24.0

The peculiar reversal of the value of mean illumination is seen in the various combinations, where, when one bay only is in operation with either four or five units (Table 2), the apparent illumination of system B is of higher intensity than system A—and, it will be surprising to note that system A gives a higher mean illumination than system B, when the same energy per square foot is used but the entire room is in service, indicating that system B employs units which produce a highly concentrated distribution of light.

The contrast between the two methods of selection of test stations and the wrong conclusions set forth, where the units have a different character of distribution, may be noted by reviewing the above commercial figures, in which the increase in illumination from surrounding lamps was given as fifty-five per cent where the proper test station shows 90.4 per cent for system A and for system B a value of twenty-four per cent was given where the true value is 49.07 per cent.

Another interesting comparison of the two systems of illumination under consideration was secured by determining the illumination in various planes from the center of the bay, the results of which (Table 4) demonstrate the general character of distribution of the systems, and moreover show that the unit which has a natural broad curve delivers by far more useful light in the extreme limits of the bay, and therefore has a superior distribution over the entire bay.

TABLE NO. 4.
Illumination in Foot-Candles.

	—X—		—Y—		—Z—	
Stations.	A.	B.	A.	B.	A.	B.
1.....	6.71	6.28	5.90	5.23	5.60	4.27
2.....	6.45	6.28	6.22	5.66	6.03	4.71
3.....	6.04	5.58	6.33	6.10	5.76	4.88
4.....	5.50	5.40	6.25	6.36	5.91	4.80
5.....	5.61	4.97	6.30	6.28	5.90	4.80
6.....	5.26	4.53	6.07	6.10	6.20	4.71
7.....	5.13	4.27	5.44	5.50	5.83	4.45
8.....	5.20	4.05	5.50	4.97	5.76	4.53
9.....	5.74	3.84	5.79	5.32	5.70	4.45
Mean.....	5.74	5.02	5.98	5.72	5.85	4.62

X—Every foot down center line of bay.
Y—Every foot down center line of lamps.
Z—Every foot down edge of bay.

A review of these results will prove that tests on lighting systems should not be based on results when one bay only is in operation, for, even in the case of relatively small rooms, the reflection from the walls is in many cases of almost equal importance to the direct light from distant units.

In proceeding with tests on illumination, after having first carefully laid out the test stations and observed the other necessary precautions preparatory to actual reading of results, as above mentioned, a voltmeter whose calibration is known should be arranged in the circuit so that the pressure impressed over the lamp terminals can be observed and recorded at each observation of illumination, for perfect conditions of regulation never exist on commercial circuits; but by observing the necessary precaution and making due corrections, where conditions on commercial circuits are other than normal, a true basis for comparative figures is established.

That a knowledge of the operating pressure is as essential as a knowledge of the illumination produced by a lamp operating at that pressure is evident, and a review of the following figures, secured by special investigation on voltage effects, will show the importance of the relation between voltage and illumination to those who are inclined to assume that the operating voltage of a system of illumination under test is about normal throughout the test.

Manufacturers of lamps provide, by label or otherwise, a permanent marking of the voltage at which every lamp is designed to operate, and at which voltage the lamp gives 100 per cent. or normal candlepower. When normal voltage is known, a voltage-candlepower characteristic, that is, a curve showing the per cent candlepower produced for various percentages of voltage above or below normal, as published by the manufacturers, may be used, for these curves represent the average performance for a type of lamp.

Since any increase in candlepower means a corresponding increase in illumination, when other conditions remain the same, it is obvious that it is only necessary to observe the operating voltage and the illumination simultaneously, and, knowing the normal and operating voltages, the illumination which would be obtained if the lamps were operating at normal voltage can be calculated by reducing the observed illumination to 100 per cent, according to the voltage-candlepower curve of the type of lamp used.

In order to determine what differences would be found by actually operating a system of illumination above and below normal, as well as at normal, and observing the operating voltage and reducing the observed illumination to normal, according to the above-outlined method, a test was conducted by holding the voltage constant over the lamps throughout the tests, at 95, 100 and 105 per cent of the normal rated voltage. Four lots of lamps of the same type and voltage were subjected to test, the results of which show the variations from the normal performance of the various lots (Table 5).

TABLE NO. 5.

	Per Cent Normal Voltage. 95	100	105
Mean illumination (foot-candles)—			
Lot A.....	4.06	4.86	6.04
Lot B.....	3.48	4.26	4.96
Lot C.....	3.35	4.02	4.76
Lot D.....	2.61	3.08	3.78
Theoretical per cent, normal illumination....	82.5	100.0	119.7
Observed per cent, normal illumination—			
Lot A.....	83.54	100.0	124.8
Lot B.....	81.7	100.0	116.43
Lot C.....	83.3	100.0	118.4
Lot D.....	84.7	100.0	122.7

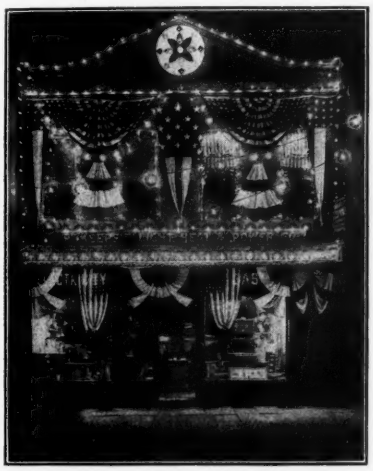
The importance of voltage at once asserts itself when illumination tests of commercial installations are made, for on commercial circuits regulation may be such that, unless very carefully watched, entirely erroneous figures may result. It is common practice among some in this work to occasionally read the voltage, and assume it is constant, provided each reading observed shows approximately the same value.

An instance of how voltage and illumination may change for short periods during a test, and the effect of same on results secured under this assumption, is clearly shown in a test where the same voltage was read at the start and again at the finish, and was, therefore, assumed to be about normal throughout the test. Simultaneous observations of voltage and illumination for each observation, however, gave a mean illumination 11.9 per cent higher than the corrected or true value.

In general, the results of all investigations demonstrate that all illumination tests should be made with the greatest possible care, giving attention to the minutest details of test methods, and, when dealing with comparative figures, an effort should be made to avoid promiscuous visual tests when the operating and normal voltage are unknown; for the effect of ordinary visual tests is, in many cases, of even greater consequence than some test errors, when the lamp purchaser (the man who usually disregards voltage and considers only the intensity produced) views the systems in operation in order to finally select the most desirable system.

Special Carnival Illumination at Poughkeepsie.

During the week of August 18 there was held in Poughkeepsie, N. Y., the annual convention of the New York State Association of Volunteer Firemen, which was made the occasion for a general carnival celebration. A particular effort was made by the Poughkeepsie Light, Heat and Power Company to make an attractive display of electrical effects, and the accompanying illustrations give some suggestion of the manner in which these were carried out.

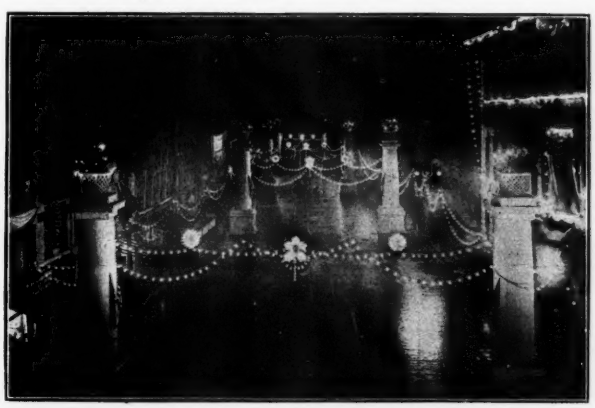


ILLUMINATION OF POUGHKEEPSIE LIGHT, HEAT AND POWER COMPANY'S BUILDING.

Special street illumination was made along Market Street and Main Street. In the former were mounted ornate white staff pillars, between which were hung chains of incandescent lamps and clusters of stars. The decoration of this street proved so attractive that it was termed the "Court of Honor." The illumination of Main Street, which, although not quite so pretentious, was also effective. The illumination of this "White Way," as it was termed, lasted for eight evenings. Nearly 20,000 incandescent lamps were in use. Besides special illumination of the streets proper, there were many buildings along these streets also illuminated in a most elaborate manner. The lighting and decoration of the building of the central-station company is shown herewith. Many of the merchants vied with each other to see who could produce the most attractive effect. The municipal building and fire-engine headquarters were also outlined with electric lights. It is proposed to keep these decorations intact until the Hudson-Fulton celebration in October. During President Taft's inauguration similar lighting effects were in use.

The city of Poughkeepsie, which has a population of some 30,000, prides itself upon the extent of these decorative and lighting efforts, and believes that this demonstration is but another example of the spirit which has resulted in its designation "Queen City of the Hudson."

The Poughkeepsie Light, Heat and Power Company deserves particular credit for its part in this display.



"Court of Honor" on Market Street.

Main Street.

DECORATIVE STREET ILLUMINATION IN POUGHKEEPSIE, N. Y.

Boston Consolidations Approved.

The Massachusetts State Board of Gas and Electric Light Commissioners have issued their approval in the case of the petition of the Edison Electric Illuminating Company, of Boston, Boston Consolidated Gas Company, Chelsea Gas Light Company, Newton & Watertown Gas Light Company, and the Waltham Gas Light Company, asking the approval of the board of the sale to the Edison Electric Illuminating Company, of Boston, of the electric locations and properties of the Boston Consolidated Gas Company and of the other companies named and also for the approval by the board of the purchase of the gas franchises and property of the Waltham Gas Light Company by the Newton & Watertown Gas Light Company, all operating in adjoining territory. The report says in part: "By the terms of the several contracts executed by these companies with each other the Edison company is to pay for the electric location and property of the Boston company $1,300,000; for those of the Chelsea company, $350,000; those of the Newton company, $500,000; those of the Waltham company, $600,000; and the Newton company is to pay $500,000 for the property of the Waltham company. The several companies also covenant that they will not further prosecute the business of furnishing electricity or gas as heretofore.

"The $1,300,000 to be paid for the electric property of the Boston company is to be used to cancel an equal amount of its floating debt. The Waltham company is to be liquidated. After its purchase of the Waltham company the capital and debt of the Newton company will be the same as they are now, as it is to receive the amount for its electric property. The outstanding bonds of the Chelsea company are to be cancelled. The direct result of the transaction will be to separate in these communities the gas business from the electric business. The facilities for furnishing and distributing light, heat and power will not in any event be diminished.

"It is clear that gas and electricity can be profitably supplied over far wider areas than was formerly thought feasible. Greater efficiency in operation and greater economies in costs are possible with a large lighting company serving a given territory than to several independent companies serving different sections of the same territory. There is a public advantage in having the gas and electric businesses separately conducted under independent control. The natural rivalry between the two should result in substantial benefits to the public."

arc, consuming 550 watts and producing 1,600 hemispherical candlepower, shows an efficiency equal to 0.34 watt per candle. In comparing these values with the well-known rating of 1.25 watts for the tungsten lamps, it must not be forgotten that this figure is based on mean horizontal and not on hemispherical candlepower. While these attainments in the production of more efficient arcs are extremely gratifying, there are considerations that govern the selection of a lighting unit, besides the simple question of light flux, regardless of whether it is for street or interior illumination; carbon life and distribution of light are two almost equally important factors.

The metallic electrode lamp, usually known as the magnetite, or as the product of another company, as the titanium lamp, is most admirably adapted for street-lighting purposes. These names are indicative of the material of which the lower pencil or electrode are formed. These pencils have an average life of 175 hours each and the maximum luminous intensity is at an angle of between fifteen and twenty degrees below the horizontal, giving an almost ideal distribution. The light is quite steady, very white and similar in appearance to the eye to the 9.6-ampere open arc, when operating at its best. The usual adjustment is for four amperes, but a few systems, notably in the City of Boston, have been installed to operate at 6.6 amperes, resulting in a vastly increased light. Electrodes made of metallic alloys produce only cathode rays, and for this reason the luminous arc is unsuited for use on alternating-current circuits, except in conjunction with a mercury-arc rectifier, in which the mercury vapor transforms or rectifies the alternating into continuous current.

The luminous arc is not suitable for indoor use on account of the fumes emitted, but is admirably adapted for street lighting and represents a substantial advance over the standard carbon arcs, in efficiency, maintenance and diffusion.

There is a field, however, in street lighting, now rapidly widening, in which even the luminous arc has been inadequate. This is the illumination of special streets and large buildings or areas, where striking effects are desired and a unit of high intensity is essential. But the ingenuity of man is usually equal to the call for improved methods, to meet new conditions, in any line of human endeavor, and in this case we perceive the evolution of the flaming arc, which is the fruit of many years of scientific effort to combine certain highly luminous salts in a commercial and efficient electrode. This lamp, with its value of 0.34 of a watt per mean hemispherical candle, even when fitted with a diffusing globe, which absorbs fully thirty per cent of the initial intensity, easily heads the list of electrical illuminants perfected to date.

Spectacular illumination has passed beyond the period of faddism and is fast becoming a permanent institution in many cities, not only as an advertising medium, but for utilitarian purposes. Despite the manifold advantages claimed for the tungsten by its hosts of disciples for street lighting on the theory of smaller units and more of them, with a consequent better distribution, the scope of their usefulness is more or less restricted, while the possibilities of high-intensity arcs are almost limitless, not only in street lighting, but for industrial installations as well. Foot-candles per watt per square foot is more often the chief desideratum, rather than perfect distribution. But a combination of both attributes is extremely advantageous and recent improvements have resulted in the development of a flaming arc, with vertically-arranged carbons, producing the characteristic curve of the luminous and ordinary carbon arc lamps, greatly intensified and with the equal advantage of comparatively long carbon life, thus removing a serious handicap that formerly existed to the general adoption of this type of lamp, on street-lighting circuits, to operate in conjunction with standard series alternating and direct-current lamps. While it is seldom possible in such installations and where lamps are used only at street intersections, to reduce the actual number used, by the substitution of flaming arcs, the illumination per square foot is, of course, greatly enhanced, with no increase in energy and a carbon cost per candle-foot of less than one-half for the latter over the former. After all, the basis of measurement for street lighting and the specific amount of light flux per square foot of surface to be illuminated is largely arbitrary and governed chiefly by what has been available under economic operation in the past; but if the standard can be raised through the medium of a more efficient unit, with no additional expenditure of energy, "it is a consummation most devoutly to be wished."

The intensive lamp previously referred to, sometimes known as the intensified lamp, is not adapted or intended for street lighting, but was developed primarily, in an effort to check the inroads of the tungsten on commercial arc lighting business, especially in that class of stores and limited areas requiring a brilliant steady light of high-unit intensity. This lamp is constructed to take carbons of very small diameter, usually about one-quarter inch in diameter, thus securing a very high current density and light of extreme whiteness, with an efficiency of about one watt per hemispherical candle and extremely good distribution. It bids fair ultimately to prove somewhat of a "thorn in the flesh" to the high-efficiency filament and possesses the added advantage peculiar to carbon arcs, of being better suited to color matching, on account of the near approach of its white rays to the solar spectrum. These lamps usually consume from four to six amperes and operate singly on 110-volt circuits. The life of carbons averages about sixty hours.

The very latest claimant for consideration in the arc-lamp field is probably the titanium carbide lamp; this is a form of lamp intended for series operation on alternating current, and therefore best suited for lighting streets and large open areas, such as railroad yards, amusement parks, etc. The electrode is composed principally of carbide of titanium, hence the name. This lamp might truly be considered in the nature of a supplement to the metallic electrode or luminous arc, in providing a highly efficient system capable of being operated direct from alternating-current machines and eliminating the necessity for current rectifiers. The efficiency is very high, being about 0.3 watt per candle-foot, but the power-factor is extremely low, being less than fifty-five per cent. It can scarcely be said to have passed the experimental stage, as its operation has not been entirely satisfactory to date, on account of unsteadiness of the arc and the tendency of the carbide vapors to condense and form slag on the electrode tips, as well as cost of the electrodes, being now about twenty cents a pair.

Such a form of lamp, however, as a more efficient substitute for the series alternating-current enclosed arc, would no doubt find immediate favor in the eyes of progressive central-station managers and municipalities, and it is to be sincerely hoped that the objectionable features may shortly be overcome and the titanium carbide lamp be numbered among the commercial possibilities in the field of illumination as a high-efficiency unit and a worthy compeer of that bugaboo of arc-light adherents, the tungsten lamp.

THE ILLUMINATING ENGINEER.

BY S. E. DOANE.

The art of illumination would be on a much firmer basis if we knew more about the subject. Possibly no new branch of engineering was ever launched with a better foundation of fact, but we too often find that our foundation of knowledge is weak in spots.

Doubtless much that the illuminating engineer needs is to-day in existence, but never having been required for engineering work it is not available for quick reference. Science has laid down many laws and has jotted down much fact which is not in available form for the busy engineer. Much remains to be discovered and elaborated.

The illuminating engineer is in a somewhat different class from any other engineer. He should not only be an engineer in the broad sense, but he should have medical knowledge of the effect of light upon the human eye, and he should also know something at least of one of the fine arts.

The National Electric Lamp Association has founded and is equipping a laboratory for the public dissemination of such knowledge as may be determined therein on the medical and physical facts underlying illuminating engineering.

A thorough and systematic search is about to be made through technical publications of all kinds without regard to the language in which they may be written.

The data obtained will be verified, if such verification is deemed necessary, and on this foundation original work will be undertaken.

The intent is to accomplish something substantial in the increase of knowledge to the advancement of the art of illumination. The results of this work will be freely published.

The needs are very great and many such laboratories could work a long time without exhausting the subject. We hope this one laboratory will do much good, and that many other organizations will pattern after it and give to this most difficult field of engineering the added scientific data it so much needs.

Hudson-Fulton Celebration.

Upon the occasion of the Hudson-Fulton celebration in New York and vicinity at the end of this and the beginning of next month, there will probably be the greatest electrical display ever witnessed. The New York Edison Company is making a special rate for celebration lighting.

TUNGSTEN SIGN LIGHTING.

BY HENRY F. SCHROEDER.

A new field of lighting has been opened by the successful development of a low candlepower tungsten lamp, especially designed for sign lighting. After nearly a year of experiment, a four-candlepower lamp has been standardized, having a voltage of one-tenth that of standard lighting circuits, so that on alternating current, by using a transformer having a ten-to-one ratio, the lamps can be burned in multiple. The lamp consumes but five watts, one-quarter that required by the four-candlepower carbon lamp, and has a long life, averaging well above 1,500 hours.

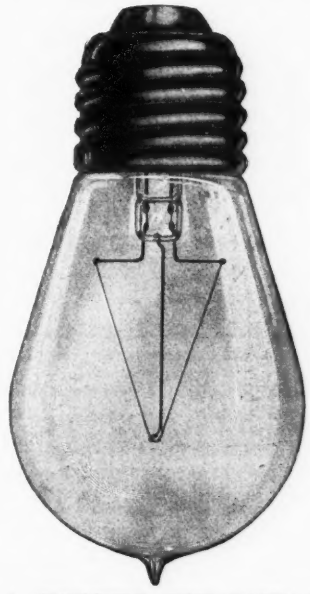


FIG. 1.—TUNGSTEN SIGN LAMP, FOUR CANDLEPOWER, TEN TO TWELVE VOLTS.

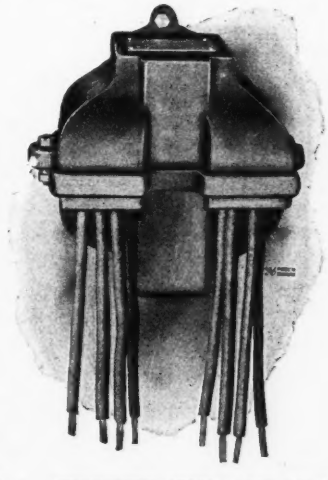


FIG. 2.—TUNGSTEN SIGN-LAMP TRANSFORMER.

The list price of the tungsten sign lamp is two-and-one-half times that of the carbon lamp, and on account of the extra ten per cent discount on standard package quantities of tungsten lamps, the actual cost of renewals is but slightly over twice that of carbon lamps. This is on the assumption that both lamps have the same average life, which is easily obtained in practice.

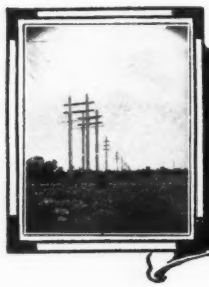
As is shown by the illustration, the filament is shaped like a wide "V," so as to give a large end-on candlepower without sacrificing the horizontal candlepower necessary for trough-letter signs. Four candles is the lowest obtainable with satisfactory life and high efficiency. Lower candlepower would necessitate a still lower voltage lamp, and on account of the shorter length of filament, the efficiency would not be as good, due to the relatively larger amount of heat conducted away from the filament by the leading-in wires.

On direct-current circuits the lamps are burned ten in series, and in signs containing 100 or more lamps, multiple series connection can be used. It is not advisable to use the latter in small signs, as if one or more lamps should burn out, the remaining lamps would have to carry an increase in current above that which they are designed to withstand.

Transformers are built with two primary and two secondary coils insulated from each other, just like a standard lighting transformer. Thus, any existing sign, wired up either two or three-wire, can be connected to any 100-120 or 200-240-volt alternating-current circuits without any change whatsoever. Flashing devices are not interfered with, but the transformer should be located on the service side of such devices. The transformers are built in capacities of fifty, 100, 200, and 400 lamps, the energy consumption being only one-fourth to two kilowatts.

The four-candlepower lamp can not only be used in signs, but can be used for decorative purposes. Higher candlepowers can be had, if desired, but it is not advisable to go above sixteen candlepower, on account of the higher current required, the sixteen-candlepower, ten or twelve-volt lamp taking four amperes. The lamps are supplied both clear and frosted. Superficially colored lamps can also be supplied with a new coloring which successfully withstands the weather.

Following is an example of the cost of running a fifty-lamp sign at a cost of ten cents per kilowatt-hour for current



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

The Buying of Coal on a Heat-Unit Basis.

Since the cost of power is a small part of the operating expense the average manufacturer does not pay the attention to the buying of coal that he does to other raw material that goes into the manufacture of his product. The most common method of purchase is to take the tons per year for some time past with the names of the various kinds that have been used and the prices paid. With this information in hand prices are obtained from various mine operators or dealers and purchase made based upon the price, the percentage of fixed carbon, the percentage of ash, or upon the reputation of the coal.

Contracts cannot be made to advantage in this way. Because the price is frequently set by market conditions or the liability of the prospective purchaser to buy, the percentage of fixed carbon does not always determine the heat value of the coal, the percentage of ash affects the heat value of a coal in some ways, but not always the same, and the reputation of a coal is not to be relied upon, because the conditions under which coal is burned plays a large part in the economy that may be obtained. All coal should be purchased only after an analysis showing the percentage of moisture, fixed carbon, ash, sulphur, and volatile matter. The cost of handling the coal, unloading it and feeding it into the boiler, the cost of handling the ash (removing it from the furnace and disposing of it), the probable effect of burning coal on the grate bars, and in some instances the smoke that will be generated, must also be taken into consideration.

Since there is such a large variety of coal the above items will vary greatly and the prospective purchaser will have a wide field to select from. The analysis mentioned is what is called an approximate analysis, and while it shows to a certain extent the value of the coal as a heat producer, further information is needed, where close buying is desired, to show the exact value of a coal. The heat test determines the number of British thermal units that will be delivered to the boiler providing the coal is properly fired and the furnace setting properly arranged.

Moisture in coal is a source of expense as it adds weight to coal, must be unloaded with the coal, put into the boiler, and evaporated, thus absorbing heat that should come into contact with the boiler shell. Each one per cent of moisture in coal means the handling of one ton of water for each 100 tons of coal, and it is not uncommon for bituminous coal to contain from four to seven per cent of moisture!

Fixed carbon is that part of the coal which is not volatile and which will burn

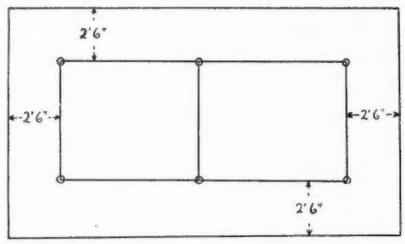


DIAGRAM SHOWING POSITIONS FROM WHICH COAL SAMPLES ARE TAKEN.

when the proper amount of air is provided. Usually in coal it is combined with the ash. The percentage of ash plays a large part in the economy with which coal may be used. It must be paid for the same as coal, must be handled to the furnace and removed, and large quantities make it necessary to be continually working with the fire. This is a disadvantage, as by having the doors open large quantities of cold air are admitted which cool the fire and the boiler, thereby having a detrimental effect upon the steaming capacity of the boiler. Bituminous coals seldom contain less than 4.5 per cent of ash.

Small quantities of sulphur are not objectionable, but large amounts will damage grate bars, cause clinkering, and corrode the boiler shell. Volatile matter is, for the large part, combustible, and every precaution should be taken to see that the boiler setting is such that it may be entirely burned. From this brief outline of the values of the various components of coal it will be seen that fixed carbon and volatile matter are the valuable properties and those that are to be desired. Of these two the volatile gases are the more important, and in those instances where the volatile matter is entirely consumed, as well as the fixed carbon, the coal may be called a smokeless coal. This condition many times depends upon the firing conditions and the boiler arrangements.

Coal is tested to determine the heat value (that is, to find the actual number of British thermal units given off by burning) by consuming a small quantity of the coal in a calorimeter. This is a device entirely surrounded by a known quantity of water at a known temperature. The coal is placed in a small vessel inside the calorimeter and completely burned. The rise in temperature of the water is carefully noted, and since the exact amount of water heated is known, as well as the rise in temperature, the number of British thermal units is easily calculated, one British thermal unit being the amount of heat required to raise one pound of water at sixty degrees Fahrenheit one degree in temperature. In order that a consumer may know exactly the quality of coal he is getting it is necessary that this test be made. Approximate analysis does not show the heat-producing value of a coal, although many dealers use it effectively in convincing prospective customers that the particular coal represented is the best, because of the large amount of fixed carbon and the small amount of ash.

Another feature in regard to the value of coal should be pointed out, and that is the sample that is taken for testing purposes. By selecting the sample carefully coal may be made to show an abnormally high value in British thermal units. There are few American coals that will, from a properly selected sample, show a heat value above 14,500 British thermal units. If the number given for any coal is higher than this it should be looked upon with suspicion until it is

demonstrated that the sampling was done in a proper manner. It has become an axiom with many persons, when several examinations are to be made of a large quantity of coal, to select the highest moisture and ash values and the lowest British thermal units value when the method of sampling is not stated.

The calorific value of coal is affected by every constituent of the coal under examination. An increase of moisture and ash will decrease the British thermal units, and vice versa. The main features of an analysis are the calorific value, the percentage of moisture, and the percentage of ash. By having the various coals offered carefully analyzed for the calorific value, and the percentage of ash and moisture, the purchaser may calculate the cost of the ash, water, and British thermal units and the coal which will cost the least from this viewpoint of heat delivered, selected.

The consumer of coal must in some way protect himself from shut-downs on account of coal shortage. This is best done by purchasing from a reliable dealer or one who controls such a quantity of coal that if the kind desired is not to be had others may be obtained. Many of the coal contracts provide for a penalty when the coal falls below a certain limit which is set at the time of purchase and for a premium of the coal of a higher quality. There are numerous forms of contracts used when purchasing coal with the price based upon the British thermal unit, each one varying in minor details to suit either the peculiar desires of the purchaser or the conditions of the coal available or the reliability of the dealer. One of the best that has come to the writer's notice is given practically complete.

FORM OF CONTRACT.

The coal furnished is to be known as ..... mined from..... seam.....mines, located at ....., in the state of.....

The coal is to be of a size that will pass through a screen not larger than two-and-one-half inches, and not less than forty per cent of which will pass through a three-quarter-inch screen, and is to be free from dirt, slate and all other foreign substances.

Delivery Cars.—All shipments to be made in (here the kind of cars desired is specified).

Quantity.—The contractor is to ship regularly an average of.....tons per day, Sundays and holidays included, for the period beginning.....and ending.....

The failure to ship any coal for ten days or the failure to ship an average of .....tons per day for any period of .....days will be deemed sufficient grounds for the annulment of the contract by the purchaser.

The contractor will be obliged to ship the quality, size and quantity of coal specified, and in the event of failure to do so agrees to accept in full payment therefor the contract price, less the dif ference in cost to the purchaser to secure such delivery.

Notification of Shipment. — The purchaser will co-operate fully in getting the cars placed and will keep the contractor informed as to the approximate amount of coal required.

Weight.—The purchaser will accept mine weights, subject to a second checking, and reserves the right to reject any cars found short of more than two per cent of the amount billed; however, such cars may be accepted after weights have been mutually agreed upon; the contractor to bear any expense, such as demurrage, car rental, etc.

Reservation. — The purchaser reserves the right to purchase coal from other parties at any time for testing purposes; such purchases not to exceed five per cent of the total quantity required during the term of the contract.

Requirements. — In the failure on the part of the contractor to ship an average of.....tons per day, the purchaser reserves the right to purchase from other parties any amount of coal necessary to make up the deficit, and should the cost of such coal exceed the figures stipulated herein, the right is reserved to deduct such excess from any balance due the contractor.

Analysis.—The coal furnished is to conform to the analysis given herein, and samples will be analyzed as often as the purchaser deems necessary.

Monthly settlements will be made on the average results of such analysis.

The purchaser will have the right to have any number of analysis made by a reputable testing laboratory, and will assume the cost thereof.

Analysis.—Sulphur, one per cent; carbon, fifty-two per cent; volatile matter, thirty per cent; ash, thirteen per cent; moisture, four per cent; British thermal units per pound of dry coal, 13,000. [These values may be changed to suit.]

Samples.—The samples for analysis will be taken from each car; four such samples will be taken from any four of the points indicated in the accompanying sketch.

The above samples will be placed in a metal-lined, locked box, and the contents will be quartered and pulverized in the usual manner, and the samples obtained will be sent to the laboratory in sealed glass jars, duplicate samples being reserved for the contractor.

Terms.—Heat Units. All coal furnished under this contract is to be paid for at the rate of $..... per ton of 2,000 pounds at shipping point, based on a heat value of.....British thermal units per pound of coal.

If the average analysis for the month shows a heat value in excess of that specified, the price will be increased in proportion to the additional heat value. If the average of the monthly analysis shows less than the specified heat value, a deduction will be made directly in proportion to the heat value shown by the analysis; however, the figures so obtained may be subject to further deductions, as follows:

Sulphur.—If the analysis shows an average in excess of one per cent of sulphur, the price will be subject to a deduction of one per cent for each one-tenth of one per cent of sulphur in excess of that stipulated, one-and-one-half per cent being the maximum allowable.

Moisture.—If the analysis shows an average of more than four per cent moisture, a deduction of one per cent will be made for each one per cent or fraction thereof in excess of four per cent up to seven per cent, which will be the maximum allowable figure.

Ash.—The purchase price will be subject to a deduction of two per cent for each one per cent of ash in excess of fifteen per cent, the maximum allowable ash not to exceed eighteen per cent.

Date.—On or about the twentieth of each month, ninety-five per cent of the preceding month's deliveries will be paid for, the remaining five per cent to be retained, as for following guarantee:

Guaranteed Funds.—Five per cent of the monthly payment will be retained by the purchaser as a guarantee for the fulfillment and carrying out of contract in accordance with conditions outlined herein, and any expense incurred by purchaser owing to failure of contractor to make shipment and fulfill all contract obligations will be deducted from this fund before final payments are made at the end of the period of the contract.

Note that all calculations relating to bonuses and deductions are to be based on total costs of coal delivered at destination.

This contract may be canceled at the option of the purchaser, if the analysis for one month shows that the coal does not conform to specifications in any one or more of the following particulars: (1) If it averages below 12,000 British thermal units per pound; (2) if the ash exceeds eighteen per cent; (3) If the sulphur exceeds one-and-one-half per cent; (4) if moisture exceeds seven per cent; (5) if the contractor fails to ship coal for fifteen consecutive days, or if the contractor fails to ship the average stipulated quantity for a period of thirty days at any time.

Rejections of Fuel.—The purchaser reserves the right to refuse any fuel not conforming to these specifications, and assumes no obligation for demurrage or switching charges, therefore, unless such charges accrue through the direct fault of the purchaser.

Relations. — Under these specifications the .....Company..... is termed the purchaser, and the..... Coal Company of.....is termed the contractor.

The Zurich Hydroelectric Plant.

Details of the new municipal hydroelectric plant at present under construction near Sils for the city of Zurich, Switzerland, are given in a recent number of *L'Electricien*, of Paris. A barrage allowing a catchment area of 420,000 cubic metres of water has been built near Nisellas, from which water will be supplied by a number of large pipes to operate six 2,000-kilowatt hydroelectric sets generating current at 7,000 volts, from which pressure the current will be stepped up by transformers to 46,000 volts for transmission over the eighty-five-mile line. The latter will have two distinct conductors and armored concrete poles will be largely used to carry the wires.

The management of the Dolcoath mine, in Cornwall, Eng., has recently made a satisfactory contract with two local power companies to supply electricity to operate motor-driven pumps in the mine and for driving the new battery of twelve electro-pneumatic stamps.

it is impossible to dispose of waste wood, shavings, etc., which may best be burned under the boilers of the isolated plant.

COST OF OPERATING BY CENTRAL-STATION SERVICE.

While undoubtedly there will be cases where the arguments of the central station may not irrefutably prove that the use of metered power will be more economical or advantageous than owned power, I do believe that a very great chance exists to add immeasurably to the central-station load for this class of service if all the salient talking points are properly marshaled to the front and the solicitor prepares himself to handle understandingly all phases of the situation. Records from a large number of central stations where woodworking plants form a goodly portion of the load indicate that the load factor of such establishments make the use of metered power decidedly feasible. For instance, one of the largest central stations in the West, with 3,522 connected horsepower, employing 234 motors (most of these group drives), found that the load factor was thirty-three per cent. With individual drives I should expect an average in many cases as low as eight or ten per cent and seldom to exceed twenty per cent.

Electric Power in Breweries.

Electric power is largely used in breweries abroad for driving malt mills, hoists, barrel hoists, grain conveyors, pumps, centrifugal pumps, portable pumps, mash tuns, mash rakes and refrigerators. Only enclosed types of motors are recommended for breweries because of the amount of steam and dust present in the atmosphere. The condensation of moisture on the walls and machinery will sometimes lower the insulation resistance of a motor to a dangerous degree. The efficient earthing of motor frames, starters, cable coverings, etc., is of the utmost importance in breweries. The floors are usually wet, and the workmen often wear iron-shod clogs on that account, so that a shock under such conditions is attended with considerable danger. Although it is an expensive method, the installation is recommended of a complete earthing system, to which all motor frames, starter cases, switch covers and metallic cable sheathing should be connected. To merely bond a motor frame on to the lead covering of a cable is inviting damage to the cable if the motor sparks over to frame or the insulation breaks down, besides introducing an element of danger of shock. Instances of the lead covering of cables being melted away at the point of contact of an earth wire, and thus leaving the faulty apparatus "alive" to shock any unwary persons, are not uncommon. The earthing system, in its turn, should be connected at several points to a water-supply pipe that always contains water, and contact with any apparatus used for heating or in conjunction with the covers should be avoided.—*Abstracted from Insurance Engineering (New York), August.*

Electric Pumping; How Not to Do It.

From time to time, says *The Mining and Scientific Press,* reference has been made to the difficulties experienced by the historic mines of Cornwall, Eng., in connection with electric pumping. The old Cornish pump has the advantage of running automatically with little attendance. It is not subject to breakdowns, nor is it expensive in power and repairs. But it has its limits of usefulness, and when unwatering operations, or sinking to great depths, are contemplated, it has become necessary for Cornish managers to investigate the claims of modern electric pumps. Unfortunately, owing to mining men not understanding the intricacies of electric machinery, and the electrical engineers not being in touch with the requirements of a mine, many of the plants so far erected in Cornwall have been failures, and mutual recriminations have been plentiful.

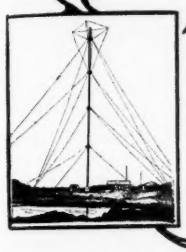
One of the most recent cases is that of Great Wheal Busy, at Chacewater. This mine was acquired a couple of years ago by a French syndicate of chemical manufacturers who were desirous of obtaining an independent supply of arsenic. The syndicate arranged with a prominent firm of manufacturers of electrical machinery in London for the supply of a pump. As is usual in contracts of this sort, there was a penalty clause providing for damages in case the pump was not delivered in working order by a certain date. The case was complicated by the contracting firm not supplying the pump itself, but sub-contracting to other firms. It is not surprising, therefore, that with all the ins and outs of contracts and sub-contracts, the efficiency of the pump and its applicability to the work in hand was obscured. In the end, there was great delay in the delivery of the pump, and when it was erected it could not be made to do its work. Consequently, the mine owners discarded it, and are now putting a Cornish pump in its place. They also brought an action for damages against the firm that supplied the pump, and judgment has been given in their favor. A sum of $13,500 has been awarded to the mine owners for the delay and the failure to work.

The moral to be drawn from this story is twofold. To begin with, in new ventures of this sort, the presence of intermediaries involved in contracts and subcontracts is highly disadvantageous to the actual contracting parties. It is a pity that the people who want a pump, and the people who design and make it, cannot get together and discuss requirements and capacities. The second consideration is that the mining engineers and the electricians ought to meet and learn each other's experience. A mining engineer accustomed to a Cornish pump imagines that all pumps, even electric pumps, should work efficiently with just as little attention and study. On the other hand, the electrician designs a pump with little or no knowledge of the rough conditions existing in a mine, and expecting the mining engineers and miners to be qualified to take care of the delicate anatomy of an electrical machine.

The Price of Rubber.

Although rubber has lately been somewhat reduced in price, the reduction will be only temporary, according to Spencer Brett, of the firm of Gow, Wilson & Stanton, Ltd., of London, England, who is quoted on the subject as follows:

"Prices for the best Para rubber have dropped from 8s. 5d. to 8s. a pound, but the reduction is quite a temporary one. It is possible that the price will not only go up again to the 8s. 5d. rate, but even higher. The state of the market is very uncertain, and one cannot say what the conditions will be in the near future. Supplies are not coming in any faster, despite the fact that so many new companies have been floated since the boom commenced. Nine new companies have been formed, representing a capital of £750,000. They are, of course, getting to work to produce rubber as fast as they can, but it will be some considerable time before the effect of their enterprise is felt on the market. The first month of this year's crop is only 100 tons in excess of the corresponding month last year, which is, of course, quite inadequate to deal with the great demand from motor tire manufacturers and makers of electrical goods, which require a large amount of rubber in their construction."



TELEGRAPHY—TELEPHONY, and WIRELESS.

EFFECT OF PHASE OF HARMONICS UPON ACOUSTIC QUALITY.

BY M. G. LLOYD AND P. G. AGNEW.

Introduction.—Ever since the celebrated controversy between Helmholtz and König concerning the influence of the phase of harmonics, this question has remained a point of dispute between the supporters of these two great experimenters. Each of them had conducted experiments which apparently supported his case, König finding that the quality was affected by phase displacement of a harmonic, while Helmholtz found no effect.

The method used by Helmholtz[1] to produce a change in phase was elegant, but open to objection. He shaded the aperture of the resonator used to reinforce the sound. This changed the amplitude as well as the phase of the vibration, and necessitated a compensating correction by altering the distance between fork and resonator. It is thus evident that the change from one condition to another could not be made with much rapidity. König's[2] experiments were made with the wave siren, which has since been shown[3] to give small quantities of extraneous harmonics. His results are therefore of doubtful significance.

The experiments to be described made use of electrical currents whose wave form could be controlled, a telephone receiver being used to transform these into sound waves.

Apparatus.—Definite composition of the electrical wave was made possible by the use of a special set of generators at the Bureau of Standards, known as the Harmonic Set. This set consists of two driving motors and eight three-phase generators, which, at normal speed, give frequencies of 60, 180, 300, 420, 540, 660, 780 and 900 cycles per second. They are assembled in two sections, the generators with the three lower frequencies being mounted on the shaft of one motor, while the others are mounted with the second motor. The two sections can be coupled rigidly together when desired. Each generator has rotating poles and stationary unslotted armature, and the position of the armature can be shifted by means of a worm gearing and hand wheel. By connecting the generators in series, and properly exciting the fields and setting the armatures, any odd harmonic up to the fifteenth can be superposed upon the fundamental frequency in any amplitude and phase relation, thus permitting the synthesis of an endless variety of wave forms. The individual generators give waves which are approximately sinusoidal, although containing a few per cent of harmonics.

Another generating set which has been used consists of two two-phase generators of sixty and 180 cycles, respectively, connected to a driving motor. These machines give nearly pure sine waves. A third generator set, furnishing three-phase and sixty cycles, was also used.

Several telephone receivers were used, but most of the experiments were carried out with a Siemens & Halske instrument of 10.5 ohms resistance. The telephone was sometimes used with a high resistance in series; at other times it was placed in parallel with an adjustable carbon resistance of low value, and the whole put in series with an incandescent lamp. Variation of the carbon resistance altered the current through the telephone. In a few of the experiments separate telephones were connected to the generators, and the sound waves combined.

Experiments.—At first the simple method of armature shift was used. Several combinations gave changes in the note sounded. But the method was neither convenient nor very sensitive, several observers and precautions to avoid suggestion being deemed necessary to firmly establish the change as taking place. The changes could be detected only with particular percentages of harmonic.

To shift the phase more quickly, a phase-shifting transformer was tried, but was found unsuitable, as slight changes in voltage and wave form accompanied the rotation of the secondary.

Finally, use was made of a second motor-generator set. By taking the fundamental from one and the harmonics from the other, and then running the machines just out of synchronism, we have one wave train slowly drifting relatively to the other, thus producing a slowly and periodically recurring change of phase.

The effect is much the same as in the arrangement used by Lord Kelvin,[4] who took two tuning forks, one of which was an exact harmonic of the other, and changed its period very slightly by adding a small weight to it, thus giving a continuous cyclic change of phase.

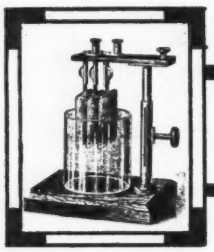
This method was found to be very much more sensitive than either of the others. In fact, with the armatures connected single-phase, every combination of harmonics tried showed distinct cyclic changes in the note sounded. By controlling the speed of one of the generators, the change in phase may be made rapid or slow, the rate being observed by means of a synchronizing lamp connected in series with the sixty-cycle generator of each set. Relative intensities of the electromotive-forces of the generators connected to the telephone could be adjusted by resistance in the field circuits. This method proved very convenient, the control being easy and flexible.

TABLE I.

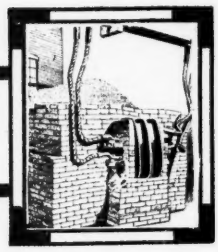
Cycles.	Changes per lamp cycle.
60	3
	15
300	15
420	21
540	9
660	33
780	39
900	15

Table I shows the results of using each frequency of the harmonic set with the 180-cycle two-phase generator. Changes in quality were evident in every case, and the number of cyclic changes occurring during a complete cycle of the synchronizing lamp were counted. This is the number of changes taking place while one

[1] H. L. F. Helmholtz, "Sensations of Tone," third edition, page 124.
[2] R. König, "Quelques Expériences d'Acoustique," page 222.
[3] R. König: Wiedemann's Annalen; volume 57, page 339; 1896. C. Stumpf; Wiedemann's Annalen; volume 57, page 677; 1896.
[4] W. Thomson; Proceedings Royal Society of Edinburgh; volume 9, page 602; 1878.



ELECTRO-CHEMISTRY and METALLURGY



RECENT PROGRESS IN ELECTRIC STEEL REFINING.

BY JOHN B. C. KERSHAW.

The article upon "The Problem of Waste Heat Utilization in Iron Works," which appeared in *The Iron Trade Review* for February 18, included some particulars relating to the progress of the electric-furnace methods of steel refining. Those who control British and American iron and steel works were urged to apply some portion of the power now wasted in their blast-furnace gases, to the production of structural and rail steel in the electric furnace.

It is the writer's purpose in the present article to amplify the information contained in the above-mentioned article and to give the latest details available relating to the electric-furnace methods of steel production.

As regards the number of furnaces in operation, the issue of the *Electrochemical and Metallurgical Industry* (New York) for January of this year, gives the following summary of the position:

	No.	Aggregate Charging Capacity in Kilogrammes.
Héroult furnaces in operation or in course of erection....	19	63,300
Héroult furnaces planned but capacity not decided.....	5	.....
Stassano furnaces in operation or in course of erection.....	11	16,900
Kjellin furnaces in operation or in course of erection....	10	21,500
Röchling-Rodenhauser furnaces in operation or in course of erection.....	10	29,200
Girod furnaces in operation or in course of erection....	9	34,000

This gives a total of fifty-eight furnaces, having an aggregate capacity of 165,000 kilogrammes, or 165 metric tons—equal to an average capacity of nearly three tons per furnace charge.

It is useful and instructive to compare with these figures the still more recent summary of progress published by the Gröndal-Kjellin Company, of London, from which the following figures are taken:

	No.	Aggregate Charging Capacity in Kilogrammes.
Héroult furnaces in operation or in course of erection....	19	74,300
Kjellin furnaces in operation or in course of erection....	14	34,950
Röchling-Rodenhauser furnaces in operation or in course of erection.....	10	30,200
Stassano furnaces in operation or in course of erection.....	11	16,900
Girod furnaces in operation or in course of erection....	10	32,800

This list gives a total of sixty-four furnaces, with an aggregate capacity of 189,150 kilogrammes (equal to 189 metric tons), either in operation or in course of erection—rather larger totals both in furnaces and in aggregate capacity, than those given by the independent inquiries and estimate of the New York paper.

In addition, there are between fifteen and twenty electric furnaces for steel production operating upon other systems than those named above, in Europe and America.

One may safely assert, therefore, that at the present moment, there are between sixty and seventy electric steel refining furnaces at work, with an aggregate capacity of over 200 tons steel per charge. Since the average number of charges worked per day in electric furnaces is two, this gives a daily production of 400 tons of electric steel, a total large enough to show that on the Continent of Europe electric steel refining has now become an important feature of the iron and steel industry.

As regards the size of the individual furnaces, the largest Héroult furnace in operation is that of the Aceries du Saut du Tarn, at St. Juery, France, this having a capacity of 5,000 kilogrammes (five tons) per charge, while a furnace of equal capacity is at work at the Halcomb Steel Company's Works at Syracuse, N. Y. The Societa Tubi Mannesmann, at its works at Dalmine, in Italy, is just completing, however, two 6,000-kilogramme furnaces, and it will be of some interest to note whether the Héroult type of crucible furnace can be successfully worked in these larger units, most of the refining so far having been carried out in furnaces of three tons capacity. The chief difficulty with the Héroult furnace is the regulation of the current during the melting of the charge, when both arc and resistance heating are employed, great variations in the electrical resistance of the charge occurring during this stage of the heating process. As the size of the furnace increases, and larger currents are employed, this difficulty is likely to become intensified, and on this account a limit to the practical capacity of the furnace is certain to be found. The other special difficulty found in the operation of the Héroult furnace, namely, the overheating and rapid consumption of the carbon electrodes, has been overcome by the use of water-cooled stuffing boxes for these, packed with a special conducting mixture of graphite and carbon grains, which enables a large surface of

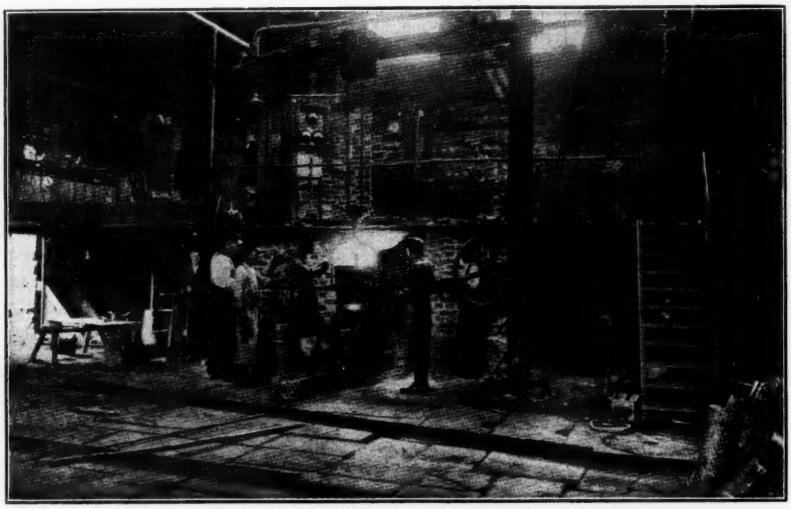


FIG. 1.—THE KJELLIN FURNACE (DISCHARGING).

the electrode to be employed for electrical connection to the cables conveying the current. Having studied completely the problem of manufacturing the higher classes of motor-car and tool-steel, Héroult is now turning his attention to the production of structural and rail steel in his furnace, and in a letter to the writer, dated January 13 of the present year, he states that he is now working at this branch of the subject with some hope of success.

The largest Stassano furnaces are to be found at the works of the "Forni Termo-elletrici Stassano" at Turin, Italy, where two 5,000-kilogramme furnaces of this type have been erected. In the case of the Stassano furnace, the heat effect is obtained entirely by radiation from two or more arcs formed above the charge, and the difficulties connected with the regulation of the current, met with in the operation of the Héroult furnace, do not occur. On the other hand, the electrical efficiency is lower, the most reliable figures showing a power consumption of 1,164 kilowatt-hours per 2,000 pounds of steel, as compared with 864 kilowatt-hours for the Héroult type of furnace.

The "Bonner Fraserfabrik," at Bonn, has erected and is working two 1,000-kilogramme Stassano furnaces, and the Italian government has two 700-kilogramme furnaces of this type at the Royal Arsenal, Turin.

As regards the Kjellin induction type of furnace, the largest in operation is that at the Krupp works, at Essen, this furnace being of 8,500 kilogrammes capacity.

A furnace of similar size, until quite recently was in operation at the Röchling Iron and Steel Works, at Volklingen; but this has now been converted into the modified Röchling-Rodenhauser type of furnace, and the remaining Kjellin furnaces are of 4,000 kilogrammes, 2,000 kilogrammes, and 1,500 kilogrammes capacity. Owing to the inability to attain a high temperature in the original Kjellin type of furnace, it can only be used as a melting furnace, and on this account its field of usefulness is limited.

Coming now to the Röchling-Rodenhauser furnace, the type which is at present attracting most attention, it may be explained that this furnace utilizes a combination of induction and resistance methods of heating, and that by this combination the difficulties due to the low temperature of the metal and slag in the original Kjellin type of furnace, are overcome. The experimental work connected with the development of this furnace was carried out at the Röchlingsche Iron and Steel Works at Volklingen, by M. Rodenhauser and Dr. Schonawa, and there are now two furnaces of the new type in operation, and one in course of erection, at the Volklingen Works, while others are operating at Remscheid and Dommeldingen, in Germany, at Bressoux, in Belgium, and at Walzenhausen, in Switzerland. The largest furnace of this type is the 8,500-kilogramme furnace now under construction at Volklingen, while the largest yet operated is one of 3,500 kilogrammes capacity at the same works.

No detailed figures for the power consumption of these large furnaces have been given, but Harden in a recent paper, read before the Faraday Society, stated that when using molten metal from the converter for charging the furnace, the power varied from 125 to 150 kilowatt-hours per ton of finished material. The corresponding figure for the Héroult furnace is 329 kilowatt-hours per ton of 2,000 pounds. No doubt under exactly similar conditions as regards the purification effected in the furnace, the power consumption of these two types of furnace would be more nearly equal.

Finally, as regards the Girod furnace; the largest in operation is one of 2,000 kilogrammes at the works of Oehler and Company, at Aarau, in Switzerland, but two furnaces of 10,000 kilogrammes capacity are now under construction at the new steel works which Girod is erecting at Ugine, in Savoy, and these were expected to be in operation in March of the present year. This works will have 22,000 horsepower available, and will be the first steelworks operated entirely by electric power. The furnace and casting house is a building measuring seventy feet wide by 350 feet long, and is at present equipped with two two-ton furnaces and with two ten-ton furnaces. The latter, according to Richards, will be operated with a current of 32,000 amperes at sixty volts, equivalent to 1,920 kilowatts, or 2,000 horsepower, and will produce eight to twelve tons of steel per charge.

The only reliable detailed figures yet published show that the Girod furnace consumes 1,136 kilowatt-hours to produce one ton of steel from scrap steel and pig-iron charged cold, but it is probable that these results will be much improved upon in the furnaces recently erected at Ugine. When molten metal is charged into the furnaces, the power consumption is reduced to 358 kilowatt-hours per ton. As pointed out above, however, the comparative figures for power consumption are of little value, without some measure for the purification effected by the electric-heating process.

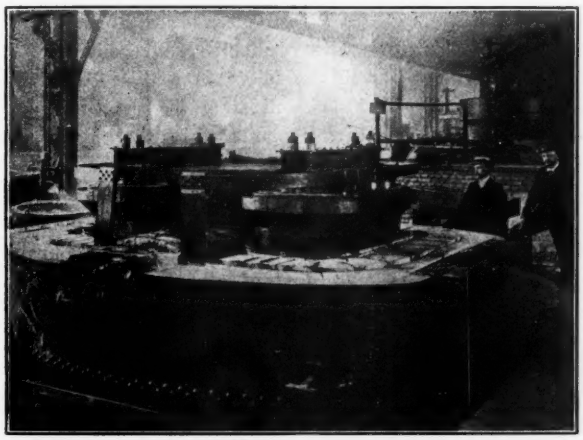


FIG. 2.—THE LARGE RÖCHLING-RODENHAUSER FURNACE AT VOLKLINGEN.

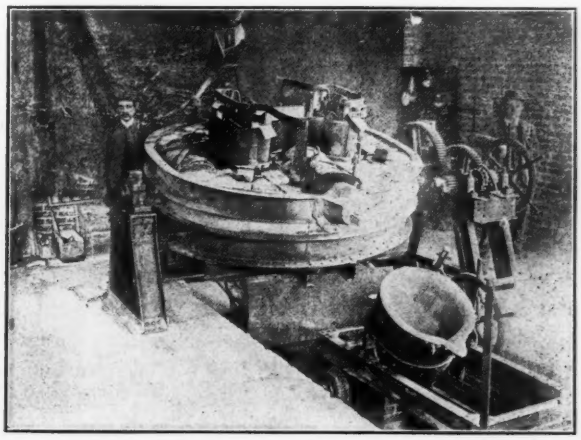
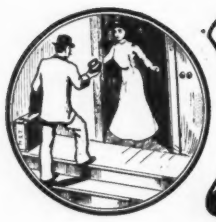


FIG. 3.—THE 140-KILOWATT RÖCHLING-RODENHAUSER FURNACE AT VOLKLINGEN.



ELECTRICAL Advertising *and* Selling

GETTING POWER BUSINESS.

BY JOHN A. CLEVELAND.[1]

The aim of every progressive central station is, in general, to increase its output. Increase in output means increase in revenue and, under proper management, increase in profits to the company. Electric power is the most profitable class of business which can be secured by any central station. It possesses several characteristics which render it especially attractive to the central-station manager. It is essentially a day-load and therefore tends to broaden out the peak-load of the station and to increase the output during those hours of the day when the load on the station is light. It is also a long-hour load and, therefore, increases the load-factor of the station. Moreover, power accounts are, in general, large each month and the distribution expense incident to each of these accounts is comparatively small, as there is but one account to keep and collect, one meter to read and keep in repair, and one service to maintain.

Electric power, therefore, being the most desirable adjunct to the central-station load, it is the object of this article to point out briefly the general methods which should be pursued for obtaining an increase in this class of business.

It is, in the first place, desirable and important that the commercial manager should have at his hand a complete file of all the users of power in his city. This file should contain individual records of each power user, showing as nearly as possible the equipment, operating conditions, probable amount of power used, and if possible the approximate monthly or yearly cost of power. The following headings will illustrate the manner in which this information may be classified upon individual cards:

Name.....
Address.....
Business.....
Boilers, horsepower and kind.....
Engines, horsepower and kind.....
Estimated maximum load in horsepower.....
Estimated average load in horsepower.....
Kind of coal used.....
Cost or quantity of coal used.....
Use of exhaust steam.....
Use of live steam.....
Number of engineers and firemen.....
Hours plant is operated daily.....

[1] Superintendent of new business departments of Bartlett Illuminating Company, Saginaw, Mich., and Bay City Traction and Electric Company. Bay City, Mich.

When a card has been compiled for each user of power in the city these cards will form a file which will enable the commercial manager to ascertain at a glance the general conditions existing at any manufacturing plant within his territory.

It is needless to say that the value of these cards depends absolutely upon the care and accuracy with which this information is secured. The solicitor who obtains this data must use not only care, but also good judgment and tact. He should explain to the manufacturer that the central station is desirous of securing whatever information it can from the various manufacturers in town to the end that the central station may, if possible, offer to the manufacturer a more efficient and economical form of power. The solicitor should, however, avoid any tendency to enter into any argument or discussion concerning electric power versus other forms of power, except in a general way. The object of his first visit should be to form the acquaintance of the manufacturer and secure all the information which he can concerning this particular plant. Without this information the solicitor is at a disadvantage, as the manufacturer will argue from a complete knowledge of his own conditions of which the solicitor knows nothing. Moreover, an attempt at argument may tend to antagonize the manufacturer at the start, a condition which must be carefully guarded against. The solicitor should point out to the manufacturer the fact that, if at any time there should occur a breakdown, or an accident to the prime-mover of the factory, and the manfacturer should need power at once to keep his machinery in operation, this information in the hands of the central station would enable the central station to ascertain at a glance the conditions at this factory, and it could then quickly arrange to furnish enough power to keep the factory in operation until the necessary repairs were made. Many times a break-down of this kind offers the opportunity to the central station of temporarily installing electric power which results in the permanent use of this power and the abandonment of the old equipment. It may happen that the manufacturer himself will be unable to furnish the solicitor with all the information which he may desire. In that case the solicitor should, with the manufacturer's permission, talk with the engineer or foreman of the shop, from whom accurate information may usually be obtained upon all these points.

The commercial manager having, then, secured a complete record of all the manufacturing establishments, his next step should be to go over this file carefully and pick out from the list those manufacturing plants which in his judgment offer the best field for the introduction of electric power.

The solicitor then starting out to secure some individual power business should, first of all, study the record of this manufacturer as outlined upon the card record. He should then call upon the manufacturer, state the object of his visit, and secure permission to present an estimate upon the cost of electric power. If the manufacturer is approached in the proper way there is no reason why the solicitor should not be granted an opportunity to present his case. Having then aroused the interest of the manufacturer, the solicitor should proceed to make a careful and detailed study of this individual plant. He should supplement and add to the information already secured and study carefully and exhaustively all the conditions under which the plant is operated. He should confer with the engineer and from the engineer's knowledge and from his own observations he should arrive at an estimate of the maximum load of the plant, the average load, and the daily hours' use of the maximum load. It is sometimes advisable to conduct an indicator test of the engine, thus determining the actual running load, the load of the various parts of the plant and the friction load of engine and shafting. The solicitor should inspect carefully all parts of the factory, proceeding from the prime-mover outward, and should note all inefficient methods of power transmission, the various losses which exist in belt drives and long

lengths of shafting and countershafting. He should ascertain from the engineer the approximate amount of fuel used per day, and from the foreman the hours per day that each machine or group of machines is operated, and should note carefully and accurately all items which will have any bearing upon the information which he is to secure.

The solicitor is then ready to prepare an estimate upon the cost of electric power and the greatest care and accuracy should be used in preparing this report. The report should show clearly the probable monthly power consumption in kilowatt-hours, which at the stated rate would amount to a definite amount of dollars and cents per month. It should show the complete cost of the proposed electric installation and the number and size of the various motors to be used. A comparison should then be drawn between the present operating costs and the cost of electric power. In the cost of operating by steam power care must be exercised to include all the various items incident to the use of such power. This cost will, in general, include labor of engineer and fireman, cost of coal, water, oil and waste, the removal of ashes, repairs to engine and boiler, and repairs to shafting and belts. The rental value of the space occupied by the plant, and the damage from heat and vibration, as well as poor sanitary conditions, should also be noted and remarked upon.

The solicitor is now prepared to present his case. He has studied the conditions of this plant until he knows them as well as the manufacturer himself, and he is therefore prepared to meet the manufacturer upon even ground. The solicitor has been fair and just in his estimates, has studied the conditions carefully, and has gained the confidence of the manufacturer. It now remains for him to convince the manufacturer that electric power is the best form of power for him to use. To do this he must point out the many advantages of electric power, its reliability, convenience, flexibility and finally its economy in operation. He must be sincere in his statements, logical in his deductions, and convincing in his arguments. He must avoid generalities and make specific statements and support them with facts and figures. He must recognize the fact that in attempting to secure business of such importance that mere persuasion and eloquence will not avail. The manufacturer is going to look upon a proposition of so much importance to himself calmly and judicially, and is not going to spend what he may consider a large sum of money and throw out his old system of power until he is convinced that he will be a gainer in the end. The solicitor, therefore, must base his arguments upon logic and reason to the end that the manufacturer shall be convinced, and these arguments must be driven in so deep that there shall be no room for after-doubts.

It is not only toward the large manufacturers, however, that the commercial manager should direct his energies and the work of his solicitors. For every manufacturer operating a plant of any size there are probably ten or more smaller ones. These small manufacturers do not use much power individually, but collectively they form a power load of no mean importance. These small manufacturers use either gasoline or small inefficient steam engines, and it is among these people that the solicitor will find a quick appreciation of the advantages of electric power. It may be desirable and necessary for the central station to offer some of these prospective customers a motor for, say, one month's trial. If this is done it will be found that only in extremely rare cases will the customer return to his old engine. The convenience, reliability, ease of operation and the uniform power furnished by the electric motor power will easily win in the end.

The commercial manager should always bear in mind that every addition to his power load, however small it may be, is worthy of his consideration and careful attention. A great deal depends upon the cultivation of a sentiment favorable to the use of electric power and every customer becomes in himself in many ways an advertiser of electric power.

Central-Station Advertising Made Effective by Appealing to Children.

The large amount of advertising literature that is being sent through the mails would give one the impression that this form of advertising is being overdone, especially, considering that a large share of it finds its way to the waste-basket. However, given a good mailing list and the proper kind of literature, very successful results are obtained.

Proper kind of literature carries a suggestion that is indeed a vital one. Advertising is distributed to be read, and to accomplish this it must first be attractive. It should have a striking opening sentence, or a bold dash of color, or a picture full of life and action, or, better still, all of these combined.

A style of literature that has become very popular for advertising purpose is one using nursery rhymes for conveying a message. These are not only attractive to the individuals to whom sent, but frequently become the property of the children, and are held constantly up to one's attention. For a residence-lighting campaign they are particularly adaptable.

DETROIT EDISON COMPANY'S BOOKLET FOR RESIDENCE CAMPAIGN.

An example of this form of advertising is shown in the accompanying illustration of a booklet distributed by the Edison Illuminating Company, of Detroit, Mich., entitled "Alice in Switchland."

The quality of paper used is of the best, the colors are bright and distinctive, the illustrations are amusing and the verses short and to the point.

It is of the class to attract attention and undoubtedly will serve its purpose very satisfactorily.

The verses are composed to show the many electric devices that add to the comfort and luxury of the home and lessen the labor of housekeeping.

The British Association Meeting.

The recent meeting of the British Association for the Advancement of Science, which was held at Winnipeg, Manitoba, Canada, commencing August 25 last, produced much that was of electrical interest, not the least remarkable being a fine address by the president of the association, Prof. Sir J. J. Thomson, of Canbridge University, England, a fuller abstract of which will be given in an early issue of THE ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

PRESIDENT'S ADDRESS.

Professor Thomson, in dealing with the wonderful developments in Canada during the past twenty-five years, pointed out that even the "enterprise and energy of your people and the richness of your country would have been powerless to effect this change without the resources placed at their disposal by the labors of men of science." Later he compared the university training of Canada with that of Cambridge in the mother country, pointing out that Canada had avoided the scholarship extravagances of Cambridge. He pleaded in the interests of physics for a greater study of mathematics by physicists and of physics by mathematicians in the interest of pure mathematics. He thought that of late years there had been some tendency for mathematical and physical sciences to drift apart, and the workers in applied mathematics are relatively fewer than they were some years ago. This was no doubt due to some extent to the remarkable developments made in the last few years in experimental physics on the one hand and in the more abstract and metaphysical parts of pure mathematics on the other. The fascination of these had drawn workers to the frontiers of these regions, who would otherwise have worked nearer the junction of the two. In accordance with the usual practice of presidents of the British Association, Professor Thomson then proceeded to give a short account of some of the more recent developments in the branch of science which he more particularly represented — physics — with some remarks on the new conceptions of physical processes to which they have led.

ENGINEERING SECTION TOPICS.

In the Engineering Section, the presidential address was delivered by Sir W. H. White, and among the matters of electrical or allied interest to come before this section were "International Electrical Standardization," by Ormond Higham; "The Distribution of Dielectric Stress in Three-Phase Cables," by W. M. Thornton and O. J. Williams; "The Engineering Works of the Panama Canal," by Colonel Goethals; "Losses from High-Tension Overhead Lines Due to Brush Discharge," by E. A. Watson; "On the Calculation of the Charging Currents in Three-Core Cables and Overhead Transmission Lines Supplied with Three-Phase Currents," by Prof. E. W. Marchant; "The Work of the British Association Committee on Gaseous Explosions," by Dugald Clerk—the second report of this committee was submitted; the first gave rise to an important debate at last year's gathering at Dublin.

OTHER ELECTRICAL TOPICS.

Among the subjects coming before other Sections were the following: "Mercurous Sulphate for Standard Cells," by Charles Fox, and "The Constancy of the Hydrogen Gas Electrode," by the same author.

A paper on Clark and Weston standard cells, contributed by H. L. Bronson and A. N. Shaw, dealt mainly with the accuracy and reproducibility of Clark and Weston cells, the authors' hope being to throw further light on the value of the cell as one of the two legal electrical standards. The work was greatly facilitated by the courtesy of the Bureau of Standards at Washington, where one of the authors spent some time in 1908 in studying the construction of modern standard cells. The authors had actively co-operated with the Bureau in the work it had been doing along these lines. In the four main sections of their paper they dealt with: (1) The reproducibility of the cells when prepared according to the specifications of Wolff and Waters; (2) the effect of introducing slight simplifications into the preparation of materials; (3) the relative value of cells set up according to the Board of Trade specifications, and those set up according to the specifications of Wolff and Waters; (4) the ratio of the electromotive-force of the Weston cell to that of the Clark.

Abstracts of some other papers presented at this meeting follow:

THE ELECTRICAL CONDUCTIVITY OF SOLUTIONS OF IODIDE AND OF PLATINUM TETRA-IODIDE IN ETHYL ALCOHOL.

BY E. H. ARCHIBALD AND W. A. PATRICK.

When solutions of iodine in ethyl alcohol were examined as to their power of conducting the electric current, it was found that the conductivity increased rapidly with the time. This change appeared to be due to the progress of a reaction, the speed of which was greatly accelerated, at low temperatures, by the platinum block of the electrodes. At twenty-five degrees centigrade the conductivity reaches a maximum in about twenty-five hours. The reaction goes on extremely slowly if platinum block is not present. As a result of this reaction the color of the solution becomes lighter. The initial conductivity of the iodine-alcohol solution was very small. No evidence could be found of the formation of an addition compound between the iodine and alcohol at as low a temperature as minus eighty degrees. Platinum tetra-iodide forms good conducting solutions with alcohol. The molecular conductivity soon reaches a constant value.

THE EFFECT OF TEMPERATURE VARIATIONS ON THE LUMINOUS DISCHARGE IN CASES FOR LOW PRESSURES.

BY R. F. EARHART.

For this investigation a small glass bulb was used, in which two parallel electrodes were sealed. These electrodes were five millimetres apart. Suitable tubes permitted the bulb to be evacuated, the pressures being measured with a McLeod gauge. The bulb was contained in an electric furnace, which could also be used as a container for carbon dioxide snow when measurements for discharges occurring at low temperatures were taken. Potentials required to produce a luminous discharge for pressures varying from 0.2 millimetre to five millimetres were made, and for temperatures varying from minus seventy-five to plus 325 degrees centigrade. The gases operated upon were air, hydrogen and carbon dioxide. Potentials required to maintain the luminous discharge under similar conditions were also measured. Curves showing the effects of temperature and pressure for potentials required both to produce and to maintain luminous discharge were given. They indicate that Paschen's law holds approximately for the discharge in air until temperatures in the neighborhood of 300 degrees centigrade are attained. Here Paschen's law does not hold even approximately.

NEW METHOD OF PRODUCING A CADMIUM ARC.

BY DR. T. MARTIN LOWRY.

In order to produce a cadmium spectrum of sufficient intensity for polarimetric work advantage is taken of the favorable properties of the silver-cadmium alloys. On account of their isomorphism the two metals form an excellent series of alloys, which are characterized by good mechanical properties and very high melting points. (An alloy with sixty per cent cadmium melts at a temperature as high as 700 degrees centigrade.) In striking contrast to the behavior of the pure metal, the alloy gives a steady arc which can be kept true to center by rotating the electrodes in opposite directions. The spectrum shows the silver as well as the cadmium lines, but these are so far separated that even with a low resolving power the slit of a spectroscope can be opened to its full width without any overlapping of the brilliant "blocks" of light which take the place of the usual "lines."

Japanese Visit Power Plant.

Japan's party of eighty representative business and professional men left Tacoma on September 6 in its special train for a ride over the Tacoma Eastern Railroad to Mount Rainier and Rainier National Park, accompanied by committees of the Tacoma Commercial Club and Chamber of Commerce. The party took a side trip to the power plant at Electron.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

YONKERS RAILROAD.

The report of the Yonkers (N. Y.) Railroad Company, Leslie Sutherland, receiver, for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$132,881	$140,996
Total railway operating expense.	116,877	124,400
Net railway operating revenue.	$ 16,003	$ 16,595
Taxes accrued	5,119	7,808
Operating income	$ 10,893	$ 8,787
Other income	180	214
Gross income	$ 11,074	$ 9,001
Total deductions from gross inc.	13,441	12,500
Net corporate deficit	$ 2,367	$ 3,498

WESTCHESTER ELECTRIC COMPANY.

The report of the Westchester (N. Y.) Electric Railroad Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$107,843	$ 97,747
Total railway operating expense.	99,535	104,102
Net railway operating revenue.	$ 8,308	*$ 6,355
Taxes accrued	3,996	3,569
Operating income	$ 4,311	*$ 9,924
Other income	198	137
Gross income	$ 4.510	*$ 9,787
Total deductions from gross inc.	7,375	6,250
Net corporate deficit	$ 2.864	$ 16,037

*Deficit.

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railway Company for the month of July, 1909, compares as follows:

	1909.	1908.
Gross earnings	$121,184	$110,427
Operating and taxes	55,650	55,732
Net	$ 65,534	$ 54,695
Interest	33,786	33,389
Surplus	$ 31,747	$ 21,305

FONDA, JOHNSTOWN & GLOVERSVILLE.

The report of the Fonda, Johnstown & Gloversville (N. Y.) Railroad Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$211,396	$191,947
Total railway operating expense.	92,187	89,775
Net railway operating revenue.	$119,208	$102,172
Net revenue from outside operating, debit	4,702	2,768
Total net from operating	$114,506	$ 99,403
Taxes accrued	10,482	9,599
Operating income	$104,023	$ 89,803
Other income	4,201	4,693
Gross income	$108,225	$ 94,497
Total deductions from gross inc.	82,962	84,371
Net corporate income	$ 25,263	$ 10,125

OGDENSBURG STREET RAILWAY.

The report of the Ogdensburg (N. Y.) Street Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$9,787	$8,821
Total railway operating expense.	5,564	6,982
Net railway operating revenue.	$4,222	$1,839
Taxes accrued	327	.....
Operating income	$3,895	$1,839
Total deductions from gross income	3,468	3,468
Net corporate income	$ 426	*$1,628

*Deficit.

ROCHESTER RAILWAY.

The report of the Rochester Railway Company for the quarter ended March 22, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$536,200	$597,216
Total railway operating expense.	338,486	404,589
Net railway operating revenue.	$197,714	$192,627
Taxes accrued	38,087	44,831
Operating income	$159,626	$147,796
Other income	816	1,034
Gross income	$160,442	$148,830
Total deductions from gross inc.	75,486	81,378
Net corporate income	$ 84,956	$ 67,452

NEW YORK TRACTION COMPANIES TO ISSUE ADDITIONAL SECURITIES.

The Up-State Public Service Commission, of New York state, has authorized the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company to execute to the West End Trust Company, of Philadelphia, a mortgage for $2,500,000. The corporation is authorized to issue at present $500,000 five per cent thirty-year bonds, to be sold at not less than ninety. Of the proceeds, $400,000 is to be used for the discharge of the outstanding bonds of the corporation and $100,000 for the acquisition of property and extension and improvement of facilities of the corporation.

The commission has authorized Leslie Sutherland, receiver of the Yonkers Railroad Company, to issue receivers' certificates to the amount of $65,000, payable two years from date and bearing interest not to exceed six per cent, the proceeds to be used for the purpose of discharging or refunding certificates falling due on September 10.

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 640,094	$ 606,373
Expenses	277,571	278,138
July net	$ 362,523	$ 328,235
Charges, taxes and pfd. divs.	140,251	128,361
July surplus	$ 222,272	$ 199,874
Seven months gross	3,890,160	3,589,222
Expenses	1,900,053	1,813,728
Seven months net	$1,990,107	$1,775,494
Charges, taxes and pfd. divs.	968,009	877,788
Seven months surplus	$1,022,098	$ 897,706

The directors have presented the audited statement of account for the year ending June 30, 1909, as follows:

BALANCE SHEET, JUNE 30, 1909.

Assets.		
Real estate, buildings, plant, machinery, etc., less reserves for depreciation and accrued renewals. (Appraised at $1,533,984.74)		$1,266,432.71
Stocks of raw materials, supplies, work in progress and finished product, as per physical inventories of June 30, 1909 (less reserve)		1,014,784.93
Investments in telephone companies (less reserve)		324,823.47
Notes receivable of telephone companies (less reserve)		890,546.77
Accounts receivable (less reserve)		428,395.77
Cash on hand and in banks		105,632.40
Unexpired insurance and taxes		4,227.07
		$4,034,893.12
Liabilities.		
Capital stock—		
Preferred (authorized and issued)		$1,500,000.00
Common (authorized and issued)	$4,500,000.00	
Held in company's treasury	3,000,000.00	1,500,000.00
Total stock outstanding		$3,000,000.00
Mortgage on Chicago real estate, due January 1, 1911		80,000.00
Notes payable		775,000.00
Accounts payable (including accrued wages)		42,994.97
Surplus, as per annexed accounts		136,898.15
		$4,034,893.12

PROFIT AND LOSS AND SURPLUS ACCOUNT—JUNE 30, 1909.

Balance at June 30, 1908		$108,869.30
Net income for year ending June 30, 1909, after deducting expenditures for ordinary repairs and maintenance, amounting to $40,658.19	$144,688.21	
Deduct provision for depreciation and accrued renewals	61,860.82	
Net earnings for the year.	$ 82,827.39	
Less interest on loans	54,798.54	
Net profits for year ending June 30, 1909		28,028.85
Surplus at June 30, 1909, as per balance sheet		$136,898.15

Metropolitan Street-Railway's Affairs.

A new light has been thrown on the future of the proposed reorganization of the Metropolitan Street Railway by one of the members of the joint committee of the bondholders of the Metropolitan Company. The committee represents the general collateral trust five per cent first-mortgage bonds, amounting to $12,500,000, and the refunding four per cent second-mortgage bonds, amounting to $16,604,000, leaving $1,175,000 miscellaneous underlying bonds, the grand total of all being $40,854,000.

This committee has employed the services of Stone & Webster to make a physical valuation of the Metropolitan system. As a result of this appraisal they have recommended that the only alternative to total alienation is the formation of a partnership with the city and joint operation of the system as is done in Chicago. This agreement between the Chicago City Railway Company and the city of Chicago was instituted through the efforts of L. C. Krauthoff, who is counsel for the point bondholders' committee, and Attorney-General Wickersham. So far the management has proved profitable to the municipality, and the system is being brought to the highest efficiency.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Hawthorn Flaming Arc Lamp.

After several years of extensive practical use, the flaming arc, by reason of its great brilliancy and power, its high efficiency and the pleasing effect of the light given, has demonstrated that in certain fields of usefulness it is without a peer in effectiveness and economy of operation.

The tendency of representative American manufacturers to adopt the gravity feed in preference to the clock feed found in most foreign lamps, is emphasized in the strictly gravity-feed flaming arc lamp which has recently been placed on the market by the Western Electric Company.

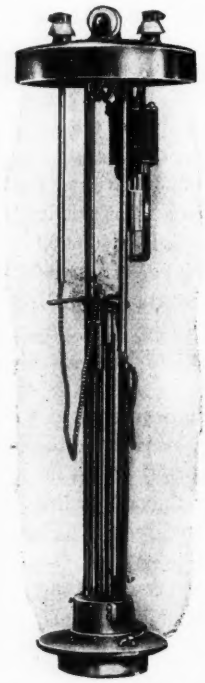
The lamp is a result of carefully conducted tests and intelligent development by competent and trained experts, and its simplicity, efficiency and general effectiveness well illustrates the skill and care exercised in the work. Beginning with more or less crude models found in certain imported lamps, and advancing largely by the process of elimination of unnecessary and undesirable parts, the lamp in its present form, both by reason of its performance and appearance, stands for all that is most advanced in the art.

The Hawthorn lamp embodies several features not found in any other American lamp, but makes use of the fundamental ideas worked out by the Deutsche Beck-Bogenlampen Gesellschaft, whose output is upward of 30,000 lamps per year, and whose lamp has been adopted as standard by the German Navy.

The new lamp maintains the carbons parallel while burning. The distance between the carbons must, therefore, remain the same, and as they are consumed there is no rise in voltage, so that shunt coils can be entirely eliminated. The lamp is simple, as may be seen from the illustration.

One carbon is provided with a longitudinal rib, which is made to rest on a metal shoe at the bottom, and in this respect is similar to the German lamp above mentioned. The other is round and is suspended from the arm attached to the ribbed carbon holder. The shoe is made a live part and is connected in parallel with the ribbed carbon. As current is fed to the shoe it generates heat, and this, plus the heat from the arc, disintegrates the rib, always keeping the carbon points below the copper shoe. This prevents the arc disintegrating or burning the metal support, which is a vital point in the successful operation of a gravity feed lamp.

The Hawthorn lamp can be supplied for either alternating-current or direct-current circuits, and for any frequency. When four or more lamps are used in series an automatic cut-out and substitutional resistance is supplied in each lamp so that one or more lamps of the series may cut without affecting the operation of the rest.



MECHANICAL CONSTRUCTION OF HAWTHORN FLAMING ARC LAMP.

It is especially well developed for illuminating main thoroughfares and business blocks, and can readily be adapted to the wiring system in use, whether multiple or series.

The following comparison of the relative cost of gas arcs, ordinary enclosed arcs and the Hawthorn flaming arc is given, based on practically the same cost per kilowatt-hour for the energy required and counting in all supplies and attendance necessary for the maintenance of the different lamps is given by the makers:

Gas arcs, 250 candlepower, four cents per hour.

Ordinary arcs, 600 candlepower, five-and-one-half cents per hour.

Hawthorn flaming arcs, 3,000 candlepower, five-and-one-half cents per hour.

Recently the German originators of the gravity feed lamps have simplified and improved their lamps by feeding the current into the carbon through the copper shoe in a very similar manner to the Hawthorn arrangement. This new type of gravity feed lamp has been very successful, being used to a large extent by the German government and by numerous municipalities for street lighting, as well as by all kinds of commercial enterprises, including railroads, factories, etc.

EXTERIOR VIEW, HAWTHORN FLAMING ARC LAMP.

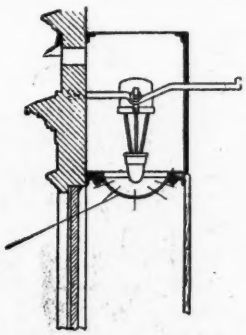
Electric Tunnel System Extended.

Great Northern officials announce plans to extend the electric system so as to run trains from Wenatchee on the east side of the Cascades to Gold Bar on the west.

Brilliant Store-Front Illumination.

A modern business street is distinguished by its brilliant illumination. Merchants are realizing more and more the strong attractive power which plentiful illumination exerts, and therefore are giving careful attention to their light equipments.

An illustration of progressive light equipment is shown herewith by a photo-



ILLUMINATION OF STORE WINDOW IN MILWAUKEE.

graph of the new store owned by G. M. Barrett & Company, Milwaukee, Wis., which was opened for business recently.

The white tile front, which is fifty feet wide, is illuminated with two "Aurola" flaming arc lamps, using carbons giving white light. They light up the section of the street adjacent to the store, and because of their great power and brilliancy, are noticed from four to five blocks away, and consequently draw the people in crowds to the store.

ILLUMINATION OF STORE FRONT IN MILWAUKEE.

The show-window lighting is done in a very novel way, the principle of which is shown by the accompanying diagram. The Holophane hemisphere diffuses the strong pure white stream of light of the "Trucolor" arc lamp, which is suspended above it.

The noteworthy features of the construction and arrangement of these lamps is that the different colors of fabrics are distinguished so correctly that there is no doubt as to their shades. Besides this, the people are not confused by glaring light.

These arc lamps were supplied by the Chas. L. Kiewert Company, 39 Cortlandt Street, New York, and 114-116 Huron Street, Milwaukee, Wis.

Aurola Flaming Arc Lamps for Alternating Current Equipped with Rapid Striker.

The alternating-current arc is more sensitive to voltage fluctuations and strong draft or small inhomogeneity of the carbon than the direct-current arc lamp. The induction-motor feeding mechanism is very satisfactory in regard to gradual and exact regulation. Should, however, the arc extinguish, it takes nearly a half minute to strike the arc anew and put it in normal condition.

The device shown in Fig. 1 is a material improvement in alternating-current arc-lamp design. It is called the "Rapid Striker" and operates as follows:

An iron core moving inside of the coil sinks down by its own weight in case the lamp is not switched on or the arc not yet established. By this downward sliding of the core, the plate which guides one of the carbons is moved in such a direction that it brings the two carbons nearly together. As soon as the lamp is put in circuit, a few revolutions of the aluminum disk are sufficient to make the carbons touch, thus striking the arc. As soon as this happens, the coil operating the rapid striker is energized, attracts the core upward and causes the guide plate to separate the carbons. A few revolutions of the motor will then establish the proper arc length.

It is clear that the operations described follow one another very rapidly, and are instrumental in starting the lamp with a minimum of current. Should the arc be interrupted for any reason, the rapid striker will immediately establish it again. In Fig. 2 is shown a photograph of the Aurola type Rw 17 flaming arc lamp with the rapid-striker attachment, marketed by Chas. L. Kiewert Company, 39 Cortlandt Street, New York, and 114-116 Huron Street, Milwaukee, Wis.

Lamps with this attachment are operating successfully on twenty-five-cycle circuits, so that Aurola lamps are available for this now much-used frequency.

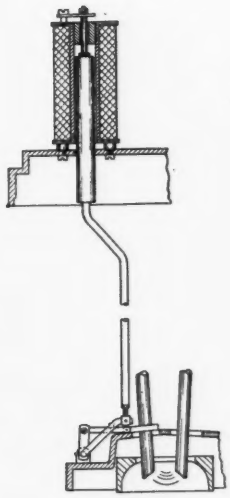


FIG. 1.—"RAPID STRIKER."

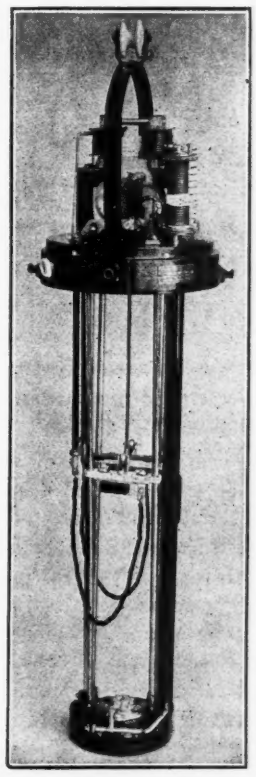


FIG. 2.—LAMP WITH "RAPID STRIKER" ATTACHMENT.

Newest Types of Excello Flaming Arc Lamps.

The Excello Arc Lamp Company, of New York, N. Y., is placing on the market new models of flaming arc lamps which are distinguished by the addition of an inner enclosing globe. All of the new Excello flaming arc lamps will be equipped with this new inner globe, which offers many advantages over its predecessor, among which may be named the

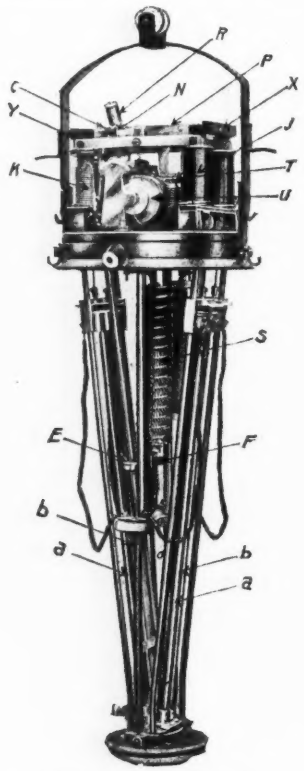


FIG. 1.—VIEW OF MECHANISM OF DUPLEX FLAMING ARC LAMP.

elimination of the deposit of ash on the outer globe; the improved ventilation of the arc, thereby facilitating the removal of ash by increased draft; and the ease with which the ash deposited in the inner globe may be removed, owing to the small surface to be cleaned.

Another new type of lamp that this company is marketing is the Duplex flaming arc lamp. This lamp is a logical development of its standard type of lamp, especially adapted to meeting the commercial requirements which emphasize the desirability of longer trimming interval and lower carbon costs than are possible with the latter type.

Longer burning periods per trim are obtained in this lamp, in which it is desirable to trim only at those periods when the lamp extinguishes itself by the complete consumption of the carbons. To accomplish this it is necessary that more than one pair of carbons be placed in the lamp at each trimming, and that suitable means be provided to insure the consumption of both pairs automatically.

Another result which has been obtained in this lamp is the avoidance of waste of carbons which is incurred whenever the standard lamp is trimmed at other periods than those due to the burning out of the carbons.

To accomplish this, necessitates the feeding of the carbons in such a manner that one pair shall be completely consumed before the other is brought into service, and that it be convenient to remove the stub of the completely burned pair, and substitute a fresh pair, without affecting in any way the adjustment of the operating pair. It is necessary that the mechanism should automatically transfer the arc from the burned-out carbons to the incoming pair, and disconnect the operating mechanism of the former from the feeding and regulating mechanism, in order that they may be replaced by a new pair which shall be cut into service as soon as the burning pair is consumed.

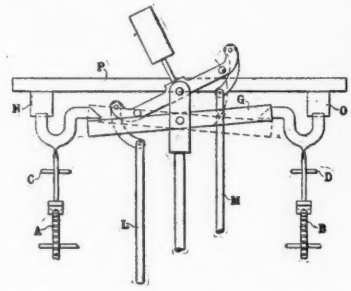


FIG. 2.—SECTION OF ESCAPEMENT AND DETENT MECHANISM.

The Duplex flaming arc lamp has been designed so as to obtain both of the results already mentioned in a satisfactory manner.

Figs. 1 and 2 illustrate the mechanical features upon which the operation of the lamp depends, Fig. 2 being a simplified representation of the escapement and detent mechanism shown by a cross-section through the walking beam P (Fig. 1), parallel to its turning axis, and viewed from the shunt magnet end.

Subway Transformers.

The transformer on top of a pole or buried under the ground, renders the same service as a generator in direct-current transmission and makes possible the distribution of energy by alternating current for commercial purposes, and therefore should be given the same amount of attention in the selection of central-station equipment as boilers, engines, generators, etc.

Many cities have abandoned pole-line construction and now require all electrical conductors to be placed underground. This necessitates the installation of transformers in manholes below the street level with an opening to the street, covered with a cast-iron cover.

In the accompanying illustration is shown a subway transformer manufac-

GENERAL VIEW OF MOLONEY SUBWAY TYPE TRANSFORMER.

tured by the Moloney Electric Company, St. Louis, Mo., which is designed to meet the exacting conditions of the underground system. It is of water-tight construction and is not affected by the damp air or surface water, which often leaks into the conduit. The size and proportions of this transformer are adapted to the limited space of the manholes and the efficiency is high, as this class of transformer is usually connected to the mains and operates twenty-four hours per day. The design also provides for operation with low temperature rise as the heat radiation is very low in a closed manhole.

Most of the details of construction of this transformer are similar to those of the well-known Moloney type H E transformers.

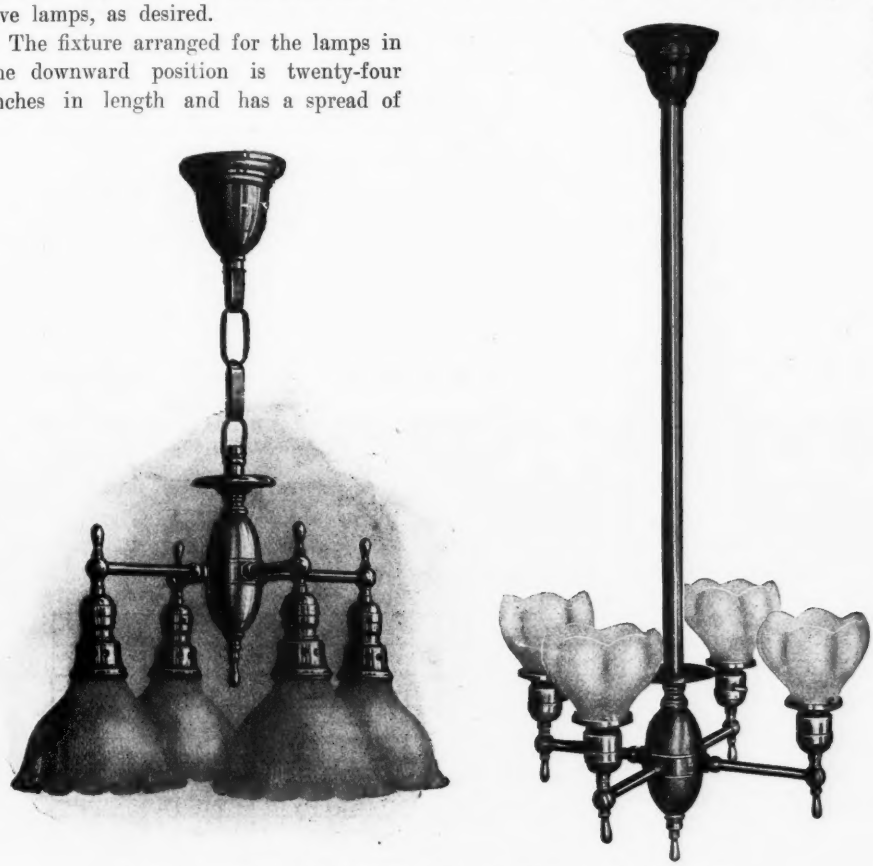
They are manufactured for standard voltages in sizes which range from five to fifty kilowatts.

Wakefield Brass Company Fixtures.

The accompanying illustrations show two styles of electric lamp fixtures being placed on the market by the F. W. Wakefield Brass Company, Vermilion, Ohio.

These fixtures are made with from two to four arms and will hold from one to five lamps, as desired.

The fixture arranged for the lamps in the downward position is twenty-four inches in length and has a spread of twelve inches. The other one shown is thirty-six inches long and has a spread of eleven inches.



TWO TYPES OF WAKEFIELD BRASS COMPANY'S FIXTURES.

In addition to the ones shown, this company manufactures several lines of both elaborate and inexpensive fixtures adaptable for various purposes. The glassware can be furnished to suit any type of incandescent lamp.

Wheeler Fluted Street Reflectors.

The Wheeler Reflector Company has specialized on lighting reflectors for nearly thirty years, and has, moreover, the only enameling plant in the United States whose product is devoted exclusively to porcelain enameled reflecting surfaces.

With this experience it is readily understood how the Wheeler fluted street reflector has achieved such distinction as it has from prominent authorities in street illumination, insuring not only a wide light distribution but a low absorption factor and light below the horizontal with a tungsten series lamp at an efficiency claimed to be 1.1 watts per candlepower.

The importance of this can be realized best from a comparison of the following:

The mean spherical candlepower of a bare tungsten series lamp is forty-eight. Now, the purpose of any reflector is to divert as much light as possible to a useful direction which in street lighting can only be below the horizontal. Photometric measurements of this lamp under a standard fourteen-inch convex deflector and under a Wheeler fluted reflector are, respectively:

WHEELER FLUTED STREET REFLECTOR.

Fourteen-inch convex reflector, 56.0 mean lower hemispherical candlepower.

Wheeler fluted reflector, 68.7 mean lower hemispherical candlepower, or an increase in useful light with the Wheeler reflector of twenty-three per cent over that with any fourteen-inch convex reflector, either plain or fluted.

The Wheeler Reflector Company, of Boston, Mass., makes also a large variety of lighting fixtures for various purposes that embody applications of the Wheeler reflectors.

TYPE OF BEARDSLEE CHANDELIER.

New Type of Beardslee Chandeliers.

That an effort is being made to digress from the conventional dome-type of fixture for use in dining rooms, libraries, halls, etc., is shown by the number of electric-lighting fixtures manufactured to suspend from the ceiling by ornamental chains or bars.

The Beardslee Chandelier Manufacturing Company, of Chicago, Ill., is placing on the market some very artistic fixtures of this type, an example of which is shown in the accompanying illustration. Husks, of floral design, completely hide the sockets in this fixture, which tends to improve the general appearance.

The metal work, trimmings and glassware can be finished in any color to harmonize with the decorations in the rooms where they are to be used.

Some Interesting Features About Tungsten Lamps.

The following are some interesting facts about tungsten lamps, in comparison with other types of incandescents.

The table below gives the lengths and diameters and filament surface of the various lamps:

TABLE I.

Filament.	Length in Inches.	Diameter.	Projected Areas Square Inches.	C. P. per Sq. In. of Projected Area.
Carbon 25 c. p.....	9.4	.0060	.0564	443
Metallized 20 c. p..	9.5	.0037	.03515	570
Tantalum 20 c. p...	23.4	.0018	.04212	474
Tungsten 80 c. p...	28	.0029	.0812	985

The resistance characteristics of metal filaments, such as tungsten, are the reverse of those of carbon. Fig. 1 shows the curves of resistance and the manner in which this changes with increasing temperature (or voltage) in the different types of filaments.

As a result of this characteristic, there is a very interesting difference in current flow in the different lamps at the moment the current is turned on. This is shown in Fig. 2, which is a reproduction of the oscillograms of the initial current of carbon, Gem and tantalum lamps, as given by Amrine, of the University of Illinois. The curve for tungsten is very similar to that of tantalum.

Table II shows the changes in candlepower and efficiency due to change in voltage on the carbon, tantalum and tungsten lamps, and these results are also given in Fig. 3.

The relative life and candlepower performance of the different lamps, that is,

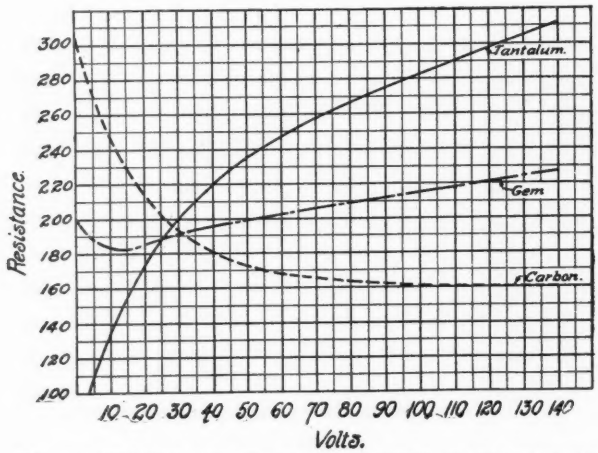


FIG. 1.—CHANGE OF RESISTANCE WITH VARIATION OF VOLTAGE OF TANTALUM, GEM AND CARBON LAMPS.

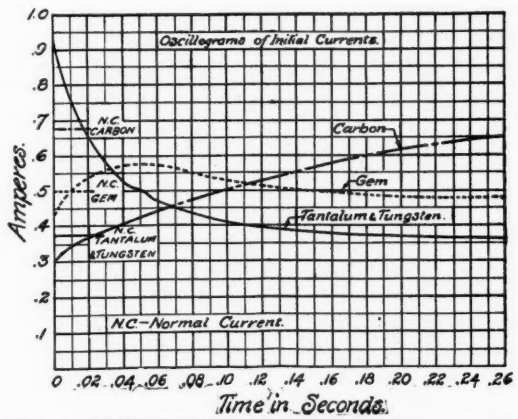


FIG. 2.—OSCILLOGRAMS OF INITIAL CURRENTS OF CARBON, GEM AND METAL-FILAMENT LAMPS.

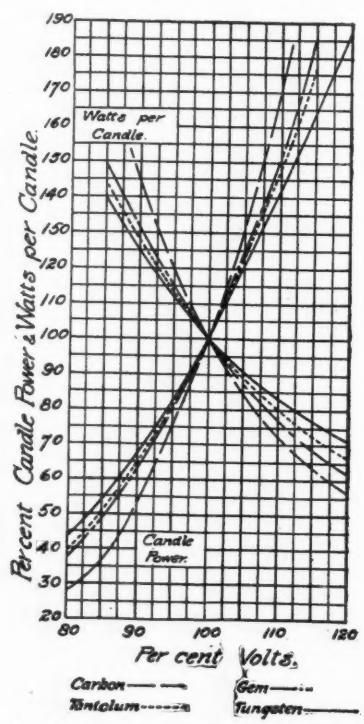


FIG. 3.—VARIATION OF CANDLEPOWER AND WATTS PER CANDLE FOR VARIOUS LAMPS WITH VARIATION OF VOLTAGE.

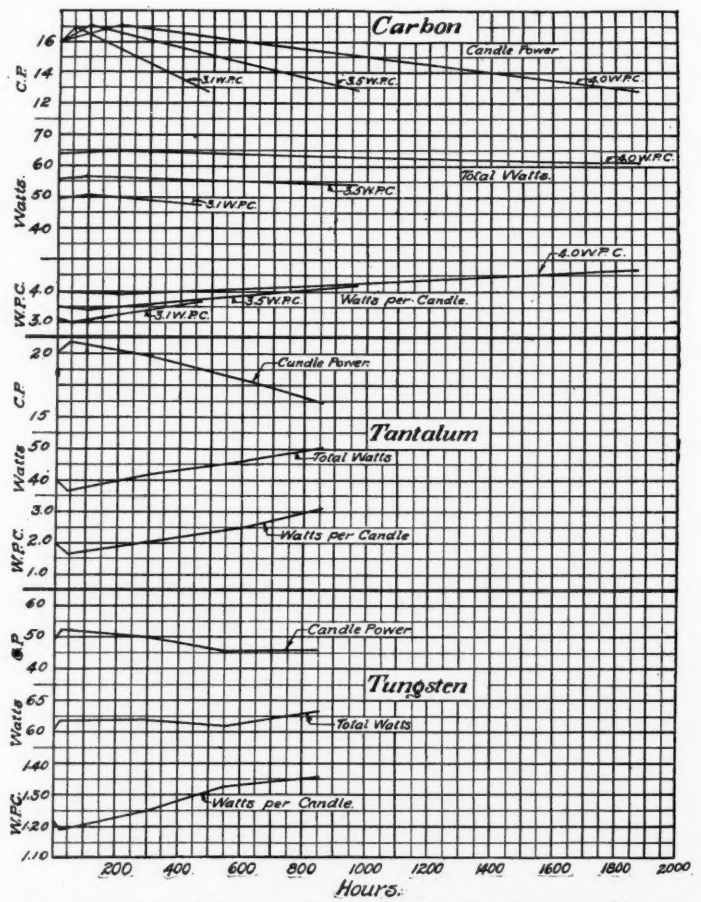


FIG. 4.—VARIATION OF CANDLEPOWER, TOTAL WATTS AND WATTS PER CANDLE DURING LIFE FOR CARBON, TANTALUM AND TUNGSTEN LAMPS.

the change in candlepower during life and also the change in total watts and efficiency (watts per candlepower) are given in Fig. 4. These curves show the remarkably long life obtained with tungsten lamps, exceeding all but that of the low-efficiency types of carbon lamps.

As is well known, the absolute efficiency of the ordinary lamp as a producer of light is very low; but this is also true of all other forms of artificial light. Excepting the arc light, the ordinary carbon incandescent lamp had a better efficiency than other lamps, averaging about 3.5 per cent of light-giving efficiency. This means that 96.5 per cent of the energy is wasted in heat and non-luminous vibrations, and only 3.5 per cent given out as light or luminous vibrations.

TABLE II.

Change of Candlepower and Efficiency Due to Change of Voltage, for Carbon, Gem, Tantalum and Tungsten Lamps.

		Carbon.		Gem.	
	Per Cent	Per Cent		Per Cent	
	Volts.	C.P.	W.P.C.	C.P.	W.C.P.
Under voltage..	80	28		36	
	85	36		47.3	
	90	52.3	145	62	131.8
	92.5	62.6	132	70.2	123.7
	95	76	120	79.6	115.5
	97.5	87.1	109.6	89.1	107.5
	100	100	100	100	100
Over voltage...	102.5	115	91.8	112	93.5
	105	130.5	84.3	124.1	87.5
	107.5	149	77.2	138	82.3
	110	169.2	71.5	152.7	77.3
	115		63	185.5	68.2
	120		56.4		61.6

		Tantalum.		Tungsten.	
	Per Cent	Per Cent		Per Cent	
		C. P.	W.P.C.	C.P.	W.P.C.
Under voltage..	80	39		43	
	85	49.3	144.5	53.1	140.3
	90	64	128	67	126
	92.5	72	120.5	75	118.9
	95	80.7	113.4	82.9	112
	97.5	89.7	107	91.2	106.5
	100	100	100	100	100
Over voltage...	102.5	111.3	94	110	95.4
	105	122.8	89.2	120	91.7
	107.5	135	84.6	130.4	86.8
	110	148	80.1	141.6	82.9
	115	177.7	74.3	164	76.2
	120		66	188	71

This absolute efficiency has been increased in the case of the new tungsten lamp to about eight per cent. This is quite a material gain, considering the marked success and are widely used. Practically ninety per cent of the series incandescent street lamps now being supplied are of the tungsten type, and it is expected that the manufacture of all other types of series incandescent lamps, such as the carbon and Gem, will be discontinued, and such lamps rendered obsolete.

The breakage record of tungsten lamps has shown a materially improved result, and at present compares very favorably with the carbon lamps, not exceeding one to one-and-one-half per cent. A large part of the tungsten shipments are made by freight, and it has been found that the lamps carry better in many cases this way than by express. In ordinary cases this would be the preferred method of shipment for tungsten lamps.

The breakage on tungsten lamps in handling, and in service in central stations and by consumers, has also been greatly reduced as the result of greater care. Table III gives some interesting information obtained from one of the large eastern illuminating companies, showing that the total breakage, including shipping, handling and early burnouts, amounts to about six per cent.

The tungsten lamp is also creating a revolution in the field of small lamps for battery service, for flashlights, automobile lights, etc.

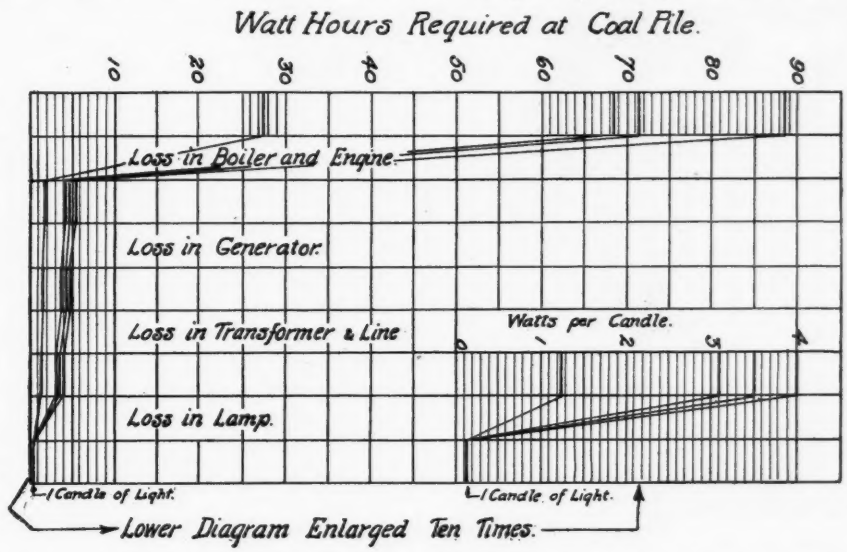


FIG. 5.—DIAGRAM OF RELATIVE LOSSES BETWEEN COAL PILE AND LAMP. GIVES THE ENERGY AT COAL PILE REQUISITE FOR ONE CANDLE OF LIGHT FROM LAMP AND SHOWS THE LARGE SAVING EFFECTED BY TUNGSTEN LAMPS OVER CARBON.

TABLE III.

Tungsten Lamp Breakage Record of a Leading Eastern Central Station Company.

Size of Lamp.....100-Watt			60-Watt		40-Watt		25-Watt		Total	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Lamps used.....	14691		9888		11392		24218		59106	
Breakage	595	4	507	5.1	941	8.3	426	1.8	2469	4.2
Early burnout.....	390	2.6	111	1.1	242	2.1	416	1.7	1159	2
Total breakage.....	985	6.6	618	6.2	1183	10.4	842	3.5	3628	6.2

efficiency of the lamp as placed at the peak of a pyramid, the base of which represents the original source of energy—the coal pile. As an illustration of this Fig. 5 has been prepared by a lamp expert and shows, in a relative way, the loss from the coal pile to the lamp and the material reduction in the base of the pyramid, that is, the reduced amount of coal required for a given amount of light from the tungsten lamp, as compared with the ordinary carbon lamp.

Tungsten series lamps have been a

Canada Has New Rubber and Insulation Plant.

The development of the manufacturing industries of Canada is going on apace. The latest announcement in this line is the incorporation of the Walpole Rubber Company, Limited, with a capital of $250,000.

The factory of the company at Granby, Quebec, is nearing completion. The main building is 120 by sixty feet and will have a basement and four stories. In addition there is being constructed a paint factory thirty by forty feet and a boiler and engine house twenty by thirty feet.

The general sales offices are in the Eastern Township Bank Building, in Montreal. The officers and directors of this new company are for the most part officers and directors of the Massachusetts Chemical Company, operating the Walpole Rubber Works, the Walpole Varnish Works, and the Walpole Shoe Supply Works at Walpole, Mass.

The Walpole Rubber Company, Limited, of Canada, will operate upon similar lines to the parent company, producing all kinds of rubber splicing, insulating and friction tapes and miscellaneous rubber sundries, together with the well-known varnishes and insulating compounds, such as Armalac, Insulac, etc.

The remarkable growth of the business of the Massachusetts Chemical Company, and the ever-increasing demand from all parts of Canada for the products named, necessitated the establishment of a manufacturing equipment in the Dominion to properly care for and encourage it. This the Granby plant is designed to do.

Dale Lighting Specialties.

The accompanying illustrations show several specialties which have been placed on the market by the Dale Company, Ninth Avenue and Thirteenth Street, New York city, especially adapted for use in the lighting field.

The Dale detachable wireless cluster is a recent product which, by reason of its practical labor-saving features, has established for itself a growing demand.

DALE CURRENT TAP.

The cluster is made in two parts, the detachable base and the cluster body. A simple pull detaches and a push and twist securely locks it. It cannot unscrew from the stem and has all porcelain insulation. The body of cluster and shade may be quickly removed without disturbing the wire connections. A great advantage of the detachable cluster is that the bases may be wired and installed, and when mechanics are out of the building the bodies, shades and lamps may be quickly attached.

TUNGSTEN LAMP HOLDER.

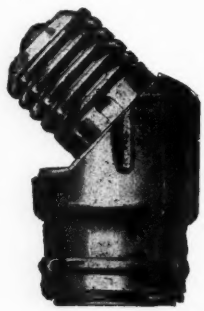
The Dale spring tungsten pendant is a new arrangement for taking up vibration, insuring long lamp life.

The new Dale canopy insulator thoroughly insulates the canopy from the stem, and does away with the riveting of the fiber to the canopy. It eliminates insulating rings, canopy collars and set screws. The clean-cut, artistic appearance of the fixture is preserved, as the insulation is practically invisible and the general appearance of the fixture is improved. The insulator is securely fastened to the stem by means of a screw-locking collar with tapering thread.

The Dale current tap is a brass-covered current tap made in both multiple and series. It allows two lights to be taken from one socket, and is especially valuable in connection with fan motors, portables, curling-irons, sadirons, etc., allowing these devices to be used and still have the use of the lamp.

DALE SPRING TUNGSTEN PENDANT.

The Dale tungsten adapter is a simple practical device with no moving or hinged parts, insuring stability and avoiding any repairs. Simply screwing the adapter into any standard socket, where at an angle, allows the lamp to point directly downward, making it unnecessary to reconstruct or rewire the fixture.



DALE TUNGSTEN ADAPTER.

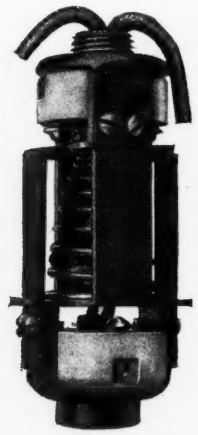
The new Dale tungsten holder is in one piece, two-and-one-fourth inches high. There are no screws, and it can be quickly and firmly attached to both socket and shade.

The company also makes a number of other lighting specialties.

The "Tungsten Life-Saver."

The American Arc Lamp Company, Kalamazoo, Mich., is marketing a new device, named the "Tungsten Life-Saver," for preventing injurious shocks from vibration to the delicate filament of tungsten lamps.

It is composed of a sensitive, helically-coiled spring, arranged between the inner ends of oppositely-disposed stirrup-like hangers. This admits of a free lateral or oscillating motion in a limited area.



TUNGSTEN LIFE-SAVER.

The device, shown herewith, may be used with any standard fixture or cluster, and when installed in stores or offices it may be entirely covered by a ceiling canopy. It is attached to the ceiling by using an ordinary crow-foot. When installed in a steel building an insulating joint is used. The tungsten "life-savers" are made in four different sizes, supporting fixtures weighing from four to fifteen pounds.

This company has also placed on the market an inexpensive, four-light tungsten shop cluster, made entirely of steel and of very few parts. It is equipped with an eighteen-inch steel porcelain-enameled shade and a light-distributing cone which extends down from the center of the receptacle plate to a point about midway of the lamps. This serves to deflect the light downward and outward into the light zone most needed, and also prevents the light of one lamp from being absorbed by the others.

The Lepel System in Jamaica.

A wireless station using a 190-foot mast and having a radius of 300 miles is being installed by the Lepel Wireless Telegraph Company in Kingston, Jamaica. There are certain difficulties in the way, it is said, which may cause the station to be removed ultimately to Bowden.

THE ILLUMINATION OF MILLS AND FACTORIES WITH SMALL UNITS.

BY E. B. ROWE AND FRANK B. RAE, JR.

To anyone who investigates industrial lighting, the most striking aspect of the subject is the indifference of hard-headed factory managers to the practical advantages of correct lighting methods. Even in plants where cost accountants and production engineers are employed to lop off every penny of useless expense and devise short-cut methods for expediting work, the economics of scientific artificial illumination are still virtually unknown. Careful analysis of conditions in a number of mills and shops shows that the average increase in efficiency (as measured by the output of machines and men and disregarding the item of spoilage which is considerably less where good illumination prevails) is between one and three per cent. This means, briefly, that a plant having a pay-roll of $1,000 per week will effect a saving of from $500 to $1,500 annually, measured either in less wages or increased output. That an item of such magnitude should escape the attention of any manufacturer seems incomprehensible, yet the blame probably can be traced to the makers of lamps and lighting equipment who so far have dealt in industrial plant *lighting* rather than industrial plant *illumination*. The distinction is not one of terms but of methods. So long as mill and factory managers are importuned to buy light they will hesitate, because in their minds light is an expense. But when they are educated to understand the economic value of good illumination as a source of increased production, the standard of industrial plant lighting will at once be raised.

That the standard must rise, and speedily, is inevitable. If factory owners will not see the practical advantages of better methods, the workmen and those who busy themselves with the workmen's welfare will. The subject has been agitated abroad with astonishing results; notably in Holland, where an imperial edict setting forth certain definite minimum intensities for various industrial requirements was issued so long ago as 1897. In France, Belgium, Austria, Switzerland and Australia the matter has had the attention of the state, and regulations covering illumination as well as heating and ventilation, are rigidly enforced. While the subject has received little official recognition in this country, there are several striking incidents to show the workmen's attitude. In a Pennsylvania textile mill tungsten lamps were introduced into one department to test their color value, and were later removed; immediately the management was approached by a committee of employes, who said that the men would buy their own tungsten lamps rather than continue to work under a lamp giving a nearly monochromatic light which proved extremely annoying. Again, in a southern city, one mill was persuaded to install tungsten lamps. Within a week this mill was overrun with applications for employment by the best operatives in the district. The other mills in that locality were compelled to install tungsten lamps to keep their hands. Nor is the lamp alone of importance. A New Jersey factory made an experimental installation of reflectors over the individual lights supplied to each machine. The experiments were presumably not satisfactory to the owners and the reflectors were removed, yet when they were taken away, each workman substituted a paper bag over the lamp to protect his eyes, and within a fortnight the factory management found itself supplying current to hundreds of thirty-two-candlepower lamps in the paper bags which the men substituted for bare sixteen-candlepower lamps.

The problems of industrial illumination and industrial power are very closely analogous, general illumination, group lighting and individual lighting being comparable to shaft drive, group drive and individual motor drive. It is quite useless and foolish to advocate one system for all conditions, either in light or power, and the man with a hobby defeats himself by endeavoring to make conditions conform to a system instead

FIG. 1.—STEEL MILL LIGHTED BY 250-WATT TUNGSTEN LAMPS AND HOLOPHANE GLASS REFLECTORS.

FIG. 2.—KNITTING MACHINES, CONDITIONS TO BE MET IN GROUP LIGHTING.

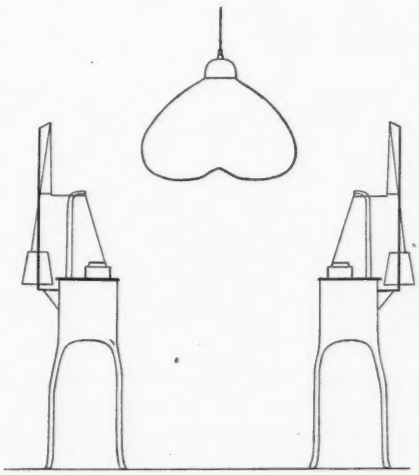


FIG. 3.—DIAGRAM SHOWING IDEAL DISTRIBUTION OF LIGHT FOR GROUP LIGHTING. (SEE FIG. 2).

of flexibly applying one or several systems to conditions as they are found. Speaking broadly, the small-unit group or individual system is preferable to the large-unit general illumination scheme, just as small motors near or at the machines are preferable to large motors and much line shaft. The problem is always one of proportions; to determine how much of each system will best serve the requirements.

Some general illumination is necessary in all industrial lighting, but in many cases a low general illumination satisfies all needs. This applies to those classes of manufacturing where general oversight of a machine or working floor must be maintained, yet where the actual mechanical operations require individual lights. Where the work does not demand close application, general illumination of moderate or high intensity serves all purposes. This latter can be supplied by almost any type of lamp, color value and efficiency being the ruling considerations. For a low general illumination, small incandescents with proper reflectors, either of glass or metal, are the only available equipment if we are to secure satisfactory uniformity; for the higher intensity, the incandescents still remain, since they are available in units of high candlepower. The advisability of using tungsten lamps is often questioned where the building is subject to any considerable vibration. However, there are a number of coiled-spring devices on the market that overcome to a large extent the breakage due to vibration, and similar devices to meet local conditions can easily be worked up by any competent plant engineer or electrician.

A unique example of tungsten lighting under conditions of excessive vibration is a steel mill illustrated in Fig. 1. In this case, we have a space 260 by 84 feet illuminated by five rows each of eleven 250-watt tungsten lamps equipped with Holophane extensive-type glass reflectors hung twelve feet six inches high and giving an even illumination of approximately two-and-one-half-foot candles at the plane thirty inches from the floor. The vibration in this case was taken care of by the use of flexible metallic cordage, the weight of lamp and reflector being just sufficient to take the kink out of the cordage while leaving sufficient spring to absorb all shock of vibration. It will be seen from this case, that the vibration can readily be taken care of, the only real obstacle to tungsten units for general illumination, where local conditions make their use advisable, being the selection of reflectors which will properly distribute the light.

This is equally true of that class of illumination which might be termed group lighting. In textile mills especially, group lighting has many decided advantages when the lamps are equipped with properly designed reflectors. Such machines as winders, spinners, twisters and spoolers are usually placed back to back with an aisle for the operatives between each double row, and these operatives are called upon to attend from two to twenty machines. These conditions (Fig. 2) call for a system of lighting which will give uniform and adequate illumination on both sides of the aisle extending over a plane having a width equal to the thread travel between rolls and spindles, or spindles and bobbins, and a length equal to that of the machine. In the past these conditions have been met with indifferent success by the installation of a system of general illumination, which is wasteful because high intensity is required upon the working plane, or by individual carbon lamps either glaringly bare or with flat tin reflectors giving practically no re-direction of the light to the useful plane or with tin cone reflectors having an equally inefficient concentrating distribution. The ideal method, however, is group lighting with forty, or sixty, or even 100-watt tungsten lamps equipped with metal reflectors giving a bowl-type or extensive-type distribution (Fig. 3).

The lighting of warping machines and looms having no overhead harness, though quite different problems from those just cited, falls naturally under the heading of group lighting. Fig. 4 shows graphically the difference between old methods and new. The warper to the right is supplied with two thirty-two-candlepower carbon lamps equipped with flat tin reflectors; that on the left has two forty-watt tungsten lamps in Holophane-D'Olier steel reflectors. In such a case, the benefit gained by protecting the operatives' eyes from the glare of the bare lamp is of almost as great practical advantage as the sixty per cent saving in current or the 100 per cent increase in useful illumination, for every mistake, whether caused by eye strain or inadequate illumination, means serious loss to both operative and mill.

While both general illumination and group lighting take care of most mill and factory requirements, there are in every industry certain operations which

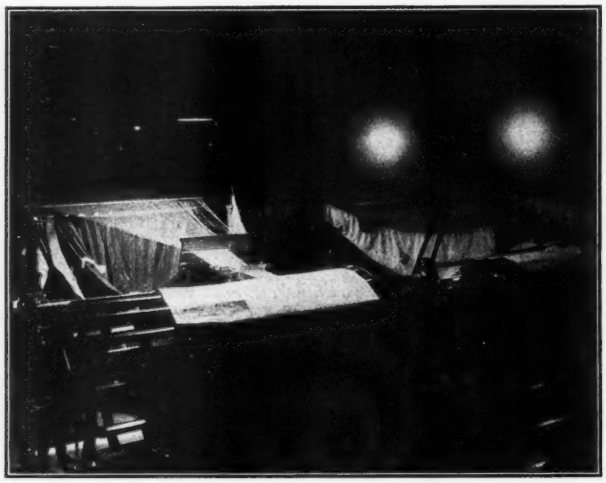


FIG. 4.—TWO FORTY-WATT TUNGSTEN LAMPS IN PROPER REFLECTORS COMPARED WITH TWO THIRTY-TWO-CANDLEPOWER CARBON LAMPS IN OLD-STYLE FLAT SHADES.

FIG. 5.—HOW THE REQUIREMENTS OF LOOM LIGHTING ARE MET BY ONE SMALL LAMP PROPERLY EQUIPPED.

demand a strong light upon a comparatively small surface. Such lighting is classed as individual lighting. Loom lighting is, in reality, in this class, though the conditions call for peculiar treatment as will be seen in the illustration (Fig. 5). Weave hands attend from two to twenty looms, the latter capacity, however, being attainable only with the modern looms having various automatic devices. Should a warp thread break on one of the older style looms and, because of poor illumination, the weaver fail to notice it immediately, there would result the formation of a "float" or "overshot." When the break is finally noticed, a "pickout" is necessary; the temples must be pulled back, all the filling threads that have been laid since the

FIG. 6.—SOCKET EQUIPPED WITH SIXTEEN CANDLEPOWER BARE LAMP.

FIG. 7.—SAME SOCKET WITH TEN-CANDLEPOWER LAMP AND PROPER REFLECTOR.

tangle commenced must be removed by a tedious combing operation, the warp beam must be turned back, and the tension of the cloth properly adjusted before the loom can again be set in operation. Meanwhile, the weaver has been forced perhaps to stop all looms under his charge, otherwise, warp threads might break on other machines, thereby causing an accumulation of stoppages. It will be seen how essential good lighting is in reducing to a minimum these occurrences and the time required for the removal of defects. Adequate and proper illumination is a further necessity in the textile industry in order that each operation may be at the same time an inspection, reducing thereby the number of pieces thrown out or classed as seconds in the final inspection.

Machine shops give the most common examples of individual lighting as this term is generally understood. Drills, lathes, shapers, grinding and polishing wheels, as well as most bench work, require not only good light, but light from the right direction.

The question of the direction of the light is of prime importance, but unfortunately is often lost sight of. The ordinary makeshift method is to provide each machine with a lamp and perhaps a flat or cone reflector. This equipment the operative ties to the machine with a string, getting the proper direction by hanging it at an angle or by cutting away one side of the cone. The more economical method—both from the standpoint of the workman's output and the current consumption of lamps—is to provide rigid or flexible arms or drop lights with angle-set reflectors so that the light shall be secured with the least delay at exactly the point it is wanted. If this is done smaller lamps may be used. In choosing reflectors, those in which the lamps set well up into the reflectors generally give the greater efficiency, while those having a roughened or matt surface avoid objectionable streaks or striations which are so wearing upon the operative's eyes.

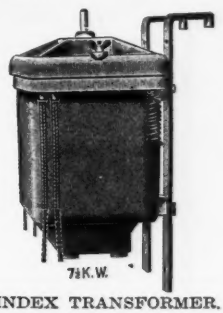
The "before and after" pictures here published are ample evidence of the importance of proper equipment for individual lights. In the one case we have as much light going into the workman's eye as is thrown upon the work; in the other, a lamp of smaller candlepower throws twice as much illumination over the work as before and the man is entirely protected. Can any factory or mill owner doubt that a man working thus comfortably will produce twenty-five per cent more work during the dark hours of the day than a man subjected to the glare and discomfort of the bare lamp?

Problems of industrial illumination are almost always problems of local conditions. Whether general illumination, group lighting or individual lights are used, depends not upon what the lighting man desires to sell, but upon what the conditions demand. To airily dismiss individual lighting as beneath consideration—as has been done by some who have only the welfare of large units at heart—is as great an error as to condemn the large units and depend wholly upon small lamps. Large units have their place, especially in the coarser sorts of manufacturing plants, but small units solve many problems and their selection and equipment are of the utmost importance.

Transformers for Tungsten Street Lamps.

When tungsten lamps are used for street lighting they are generally placed on iron poles at the curb lines. Therefore, in all such cases it is desirable that a low-voltage system of distribution be used, for, were high voltage transmitted to the lamps, a breakdown of the insulation might charge the iron poles, and thus endanger the lives of people in the street.

Transformers are being used to step down the high voltage to 110 or 220 volts, and the ordinary tungsten lamps operate in multiple, successfully, for this class of work. The multiple system requires a little more copper than the series system, but on the other hand it is claimed that the cost of maintaining lamps operating in multiple is considerably less than the cost of operating similar lamps operating in series.



VINDEX TRANSFORMER.

The Vindex Electric Company, of Aurora, Ill., is giving special attention to the manufacture of transformers for such work, the accompanying illustration being a view of one of them.

Westinghouse Series Tungsten Lighting System.

In addition to its standard constant-current regulating-transformer system, using film-gap receptacles to insure a continuity of circuits, the Westinghouse Electric and Manufacturing Company has developed to a high state of efficiency and is marketing for use with its series tungsten lamp a system of series street lighting which employs "adjuster" sockets to maintain a current of constant value in the series circuit. Contrasted with the "regulator" system, which requires a constant-current regulating transformer to supply each series circuit, and film gaps at the individual lamps, the adjuster-socket system enables the series of lamp units to be connected directly across the constant-potential distribution mains (usually 1,100 or 2,200 volts), each lamp socket being equipped with a specially designed impedance coil arranged in shunt with the lamp. If the filament breaks or the lamp is removed from the socket, the line current is forced through the coil, saturating the magnetic circuit and setting up a reactive voltage at the coil equivalent to the drop in the lamp. The current in the line and voltage at the remaining lamps thus remain practically unaffected. When connected in parallel with the lamps, the losses in the adjuster coils are very small, the efficiency of the adjuster-socket system measuring about ninety-six per cent. At the same time, the adjuster-socket system displays the extremely high power-factor of ninety-nine per cent. Contrasted with the low power-factor of the regulator system, which diminishes rapidly for partial loads, this feature will especially recommend the adjuster-socket system to the central-station manager who realizes the losses incident to low power-factor load.

For use with short lines, where the sum of the lamp voltages is not equal to that of the constant-potential mains, a special auto-transformer is supplied, having taps brought out from the winding, making available any voltage from zero to the maximum, in fourteen equal steps. The auto-transformer is designed to supply continuously two separate circuits of its rated current capacity.

The auto-transformer is assembled in a weatherproof case for outside or pole mounting. It may also be furnished with a suitable control panel having plug switches for conveniently changing taps, and an oil switch in the primary circuit, the auto-transformer and panel being then enclosed in a station or weatherproof building.

Besides the high efficiency and very high power-factor of the adjuster-socket system, its flexibility in application to circuits of any length, and the self-contained character of each lamp unit, are prominent advantages. Thus it becomes especially useful for small installations, such as for lighting factory yards, parks, drives, etc., where, with only ten or twenty lamps, it is desired to take advantage of the copper economy of the series tungsten system and the superiority of of the series tungsten lamps. With the long life of the tungsten lamp, the attention required by a series incandescent lighting system is reduced to the minimum, no other supervision being required than that of occasionally renewing the lamps which become broken or burned out.

The Westinghouse adjuster-socket series tungsten street-lighting system employs line currents of 1.75, 3.5 or 4.0 amperes, and utilizes thirty-one, forty, fifty, seventy-five and 100-watt lamps. Adapting them for any installation, street hoods for the adjuster-socket system are provided for bracket or center-span suspension with radially fluted porcelain enameled reflectors, and for bracket suspension with the street Holophane glass reflector. The impedance coil is sealed against entrance of moisture, in the cast-iron bell of the street hood. The adjuster socket is furnished with all connections completed, so that installation of the system becomes very simple, since, except on short lines, there is no regulating apparatus extraneous to the sockets themselves. Insulation has been given careful attention in the design of the street hoods while the light and distribution efficiency of the reflectors is in accordance with the best illuminating-engineering practice.

Electric Tower Wagons.

An electrically driven tower wagon has been designed in Germany by the Siemens-Schuckert Works and has proved very successful in effecting trolley repairs. The movable frame is controlled by a side lever and is adjustable between heights of 3.17 and 4.87 metres above the ground. The platform is accessible by a convenient ladder and the interior of the frame provides room for the tool case, etc. The single-motor system is used, with geared drive, and at eighty volts the motor will stand a 300 per cent overload for a short time.

An Electrical Barometer.

A unique electrical device for enabling the indications of the mercury barometer to be read with extreme accuracy has been invented by one P. B. Goldschmidt and is described in a recent issue of *The Electrical Engineer,* of London.

In this improved barometer a V-shaped carbon filament passes through the Torricellian vacuum, the bend dipping into the mercury. The two ends of the filament pass through the glass of the barometer tube at different points and are connected, one with the cathode, the other with the anode of a battery, a galvanometer being in the circuit. It is obvious that if the barometer rises the current has a less length of carbon filament to traverse than before, and the galvanometer shows an increased current, the reverse effect occurring if the barometer falls, the bend of the filament being so placed, of course, that the mercury never falls out of contact with it.

To eliminate the effect of changes of temperature on the height of the mercury column, a thermometer, provided with a carbon filament in exactly the same way as the barometer, is included in the circuit. At each reading a known resistance is added to the circuit sufficient to bring the galvanometer to the null point. From this resistance the height of the barometer can be determined within the tenth of a millimetre.

Goldschmidt's barometer has revealed a long-suspected phenomenon which the ordinary barometer cannot detect, viz., that the atmospheric pressure is continually varying, and is hardly ever the same for five minutes at a time.

Tracks Laid in Pennsylvania's Tube.

Tracks and roadbed have already been laid in the first completed tube of the Pennsylvania Railroad Company, and it is understood that the road will be finished in about two weeks, when it is proposed to install an experimental train.

Work on the mammoth bulwarks of concrete which are being erected at different points in the Pennsylvania's yards in Long Island City, some to carry the superstructure to the various viaducts on which streets and avenues will cross the tracks, and others for carrying elevated tracks, and work on the big storage building for the Pullman cars and the general supply house and the yard superintendent's office, is also being rushed in order to make available the system as speedily as possible.

PROGRESS IN THE WESTINGHOUSE-NERNST LAMP SYSTEM.

BY MAX HARRIS.

The introduction of Westinghouse-Nernst units, twelve months ago, marked the highest development in incandescent-lamp efficiency. The past year's record of progress in glower lamps has covered the perfecting of additional units, new heaters, ornamental lamps and chandeliers, and mechanical improvements to bring about further reduction in maintenance cost and ease in trimming.

Two new single-glower units were recently placed on the market, the 176 and 220-watt units. With the addition of these lamps, both of which employ screw burners for renewals, there are now five sizes of single-glower units available, as follows:

At 220 volts, 0.4 ampere, or eighty-eight watts.
At 220 volts, 0.5 ampere, or 110 watts.
At 220 volts, 0.6 ampere, or 132 watts.
At 220 volts, 0.8 ampere, or 176 watts.
At 220 volts, 1.0 ampere, or 220 watts.

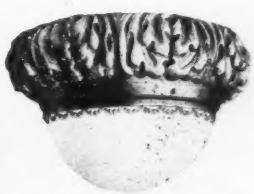
All of these units fit any standard Edison screw socket, and the two new units, on account of their low first cost, and particularly low maintenance cost, are rapidly being adopted.

The new Westinghouse-Nernst cluster is made for three sizes of burners, viz., 88, 110 and 132 watts, and is interchangeable for use with Nernst burners or other forms of incandescent lamps. The accompanying illustrations show some of the latest chandeliers, of which the Nernst Lamp Company is now manufacturing a large line in various ornate as well as plain designs. Others show two of the new ornamental forms of multiple-glower pendent and ceiling lamps, suggesting the possibilities and adaptability of these units to artistic treatment. An important feature is the new spring-type holder for multiple-glower lamps. The development of this device has made the maintenance of multiple-glower lamps so simple that anyone without the slightest electrical knowledge can replace burned-out glowers and heaters. Longer glower life is another feature resulting from the use of this holder, with resulting lower maintenance cost for material and labor. The labor item is naturally considerably reduced, since it is no longer necessary to bring holders to the station to be replaced by the inside attendant, the glower and the heater being at once renewed on the premises where the lamp is in service.

ORNAMENTAL HOUSING.

CHANDELIERS.

REFLECTOR-TYPE CLUSTER.

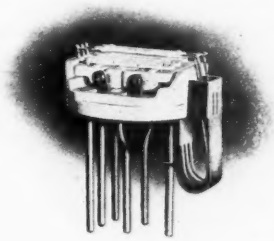


CEILING BOWL.

The design of the holder makes incorrect mounting impossible, the glowers automatically assuming their proper position. The new holders are also available for the old Nernst lamps in service.

An objection offered against the older Nernst system was the slow lighting of the lamp, and while the objection was not serious, in some cases, even when large units are employed, instantaneous lighting is desirable.

This advantageous feature has now been secured by replacing the old platinum form of heater with the new mineral heater, which itself becomes instantaneously incandescent, meanwhile lighting the glowers in from ten to fifteen seconds. The new heater is strong and durable, and its use will result in a reduction in maintenance costs. It will be made for use in all sizes of lamps of both the Nernst and Westinghouse-Nernst types.



WESTINGHOUSE-NERNST SPRING HOLDER FOR MULTIPLE GLOWER LAMP.

Past objections to the glower system, urged by its competitors, though never considered serious by its manufacturers, have thus been gradually eliminated, until even the old contention of high first cost no longer obtains. This objection was always offered on the plea that later developments in incandescent-lamp efficiency would result in writing off large investments without having earned the cost of installation by the savings effected. Not only has this failed to occur in any single instance of which the writer knows or has heard, but the objection no longer holds in view of the marketing of a complete line of universal or interchangeable clusters and chandeliers by the Nernst Lamp Company, and the recent mechanical improvements and lower prices at which multiple-glower lamps are being marketed.

The development of the screw-burner units in sizes up to the one-ampere unit (220 watts on 220 volts) makes the first cost of the screw-burner system dependent only on the elaborateness of the fixture which the user desires to employ.

For example, if the purchaser prefers one of the inexpensive clusters now avail-

able, this investment would be the same, in case either the Nernst or some other incandescent unit were employed, so that the question of renewal costs is all that is left for consideration. For the relative renewal costs of the two high-efficiency systems, the following table of list prices may be quoted:

Westinghouse-Nernst.

88-watt	$0.65
110-watt	.75
132-watt	.85
176-watt	1.05
220-watt	1.25

Tungsten.

100-watt	$1.60
150-watt	2.25
250-watt	3.25

The ruling discounts are about the same for both types of lamps. Rebates for Nernst burners are allowed upon their return.

A New White Cedar Pole Firm.

As some of the trade is probably aware, Raber & Watson, who have for years conducted a large cedar business at Chicago, Ill., Menominee, Mich., and other points, are retiring from business and have sold their business to the Crawford Cedar Company, who will be located at Menominee, Mich.

The Crawford Cedar Company will handle the cedar productions from the large output obtained from the timber holdings of Crawford and Sons, Cedar River, Mich., who have for years past been large producers of cedar in the Northern Peninsula.

William S. Patch, who has been in charge of Raber & Watson's Chicago office during their career, and prior to that with Edward E. Ayer, whom Raber & Watson succeeded, has taken the management of the Crawford Cedar Company's affairs.

Another Enemy to Wooden Poles.

It is reported that woodpeckers have been doing much damage of late to peeled cedar poles, for supporting telegraph lines, etc., in various parts of the country. These birds seem to have formed a preference for the poles to bore in for their nests rather than in decayed tree stumps, as was hitherto their usual custom. A casual inspection of the poles showed that those treated with creosote were not attacked, and an investigation is under way to prove whether creosote is always a deterrent to the attacks of the birds. If this is so, the creosote will serve the twofold purpose of protecting the poles from both birds and insects.

Intensified Arc Lamp.

The "intensified" enclosed arc lamp marks a distinct advance in the field of interior illumination, incorporating as it does all the advantages of the enclosed arc lamp, together with numerous improvements. For years the enclosed arc lamp has been greatly in favor for general mercantile lighting, in virtue of the whiteness of its light, low maintenance cost, and high efficiency. By a radical change of design, the "Intensified" arc lamp maintains these special points of superiority even, it is said, over the other improved artificial illuminants.

In the construction of the new lamp two upper or positive carbons, six millimetres in diameter and 305 millimetres in length, are placed in converging tubes, so that the ends of the carbons are in contact. A self-acting weight bearing down on the top prevents one carbon from being consumed faster than the other.

FIG. 1.—INTENSIFIED ARC LAMP.

One lower or negative carbon is used, nine-and-one-half millimetres in diameter and 100 millimetres in length. The lower carbon holder is movable in a vertical direction, being attached to a counterweight mechanism through which the action of gravity tends to hold it in contact with the upper carbons. The magnets, acting through a clutch on the rod of the counter-weight mechanism, draw the lower carbon downward away from the upper ones. In this way the magnets cause the carbons to strike and maintain the arc, keeping the lower carbon floating at the point of electrical equilibrium.

When an arc is formed, the current density is much greater at the carbon tips than in the case of the standard enclosed lamp and, as the resultant heat cannot be readily dissipated, the carbon tips pass beyond the usual red-hot poker stage to the incandescent or white-hot state.

In order to obtain the highest efficiency possible, a small diffuser is used, located directly above the arc. In this way a greater percentage of the light is distributed in the lower hemisphere. The resultant efficiency, therefore, is equal to about one-and-one-fourth watts per mean lower hemispherical candlepower at five amperes and 110 volts direct current.

The distribution of light, as shown in Fig. 3, is ideal for interior illumination, since maximum intensity is obtained on the working plane where most needed. Perhaps one of the most noticeable features of the lamp is the daylight effect created when in use. The light is of a soft, almost perfect white, tone, and is steadily and evenly distributed. So pleasant and restful is the lighting produced, one is hardly conscious of the illumination.

FIG. 2.—LINK SUSPENDED INTENSIFIED ARC LAMP.

At five amperes and 110 volts direct current, a carbon life of seventy-five to one hundred hours is obtained. This long life, together with the high efficiency, reduces the maintenance cost to a minimum. The lamp, as manufactured by the General Electric Company, can be furnished for either direct-current or alternating-current multiple circuits.

Figs. 1 and 2 represent the "Intensified," equipped with ornamental casing.

It will be noticed that this lamp differs materially from conventional designs and has very pleasing lines. The outer globe

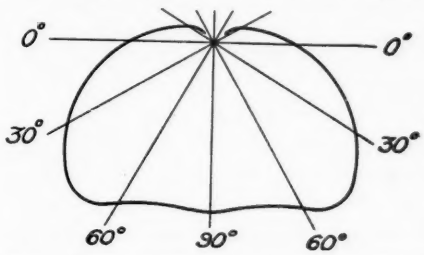


FIG. 3.—DISTRIBUTION CURVE OF INTENSIFIED ARC LAMP.

is made of leaded glass to correspond in effect with the casing. The lamp will therefore appeal particularly to dry goods, clothing and department stores, as it fills a long-felt want for an illuminant which is attractive by day as well as by night, and at the same time which meets the requirements of high-grade illumination and minimum cost.

Progress with the "I-Comfort" System of Indirect Illumination.

The "I-Comfort" system of indirect illumination, while only presented to the public a year ago, has made great strides in public favor since that time. Architects and illuminating engineers have long looked for some practical system of indirect illumination, and now that tungsten lamps are coming into such general use, this system is considered opportune. It is particularly interesting to central stations, as sixty and 100-watt lamps are used, and while it is acknowledged that there is approximately a twenty-five per cent absorption of light by indirect use, the consumer is well protected, as it is contended by medical authorities that the human eye can see twenty-five per cent better when there is no brilliant light source in range of vision.

This system is, of course, more generally known in Chicago and the middle West, but its introduction in all parts of the country is becoming general. Since the ballroom shown here, which was first opened two weeks ago, it has been decided to illuminate several large auditoriums in this way, one being the new First National Bank of Denver. Marshall & Fox, architects of the Maxine Elliott Theatre, New York, are planning to install this system quite generally in the new Blackstone Hotel, now in process of erection on Michigan Avenue, Chicago.

THE MAIN BALL ROOM, TWENTY-EIGHT-FOOT CEILING, SHOWING THE THREE LARGE CHANDELIERS, EACH CONTAINING TWENTY-THREE "I-COMFORT" INDIRECT LIGHTING UNITS USING 100-WATT TUNGSTEN LAMPS.

Among other installations of indirect illumination recently made using the "I-Comfort" system might be mentioned an interesting one in the Art Institute, Chicago, by D. H. Burnham & Company, for the Commercial Club. Here are shown (on the four walls of a large gallery) the plans and water-color sketches of "Chicago Beautiful." The four walls of the gallery are completely covered with these, each framed and covered with glass. To illuminate this room so as not to have any annoying reflections from the pictures was a problem solved, apparently, by indirect illumination.

The Hamilton National Bank, occupying the ground-floor corner of the Home Insurance Building, corner Monroe and La Salle streets, Chicago, also has a notable example of this indirect lighting scheme. The ceilings are but ten feet high. Without exception every employe speaks with enthusiasm of the comfort of working under the indirect system. Every direct light has been eliminated, even over the paying and receiving tellers' windows, where it has heretofore been supposed nothing but a strong direct light could be used.

The Chicago Beach Hotel, where the first installation of the "I-Comfort" system for hotel use was made, has had such pleasing results that the manager has recently installed the system in a second dining room and also in the card rooms.

The United States Government, after having tried out the system in New York, is now specifying it in various places.

A Practical Man's Opinion on the Electrification Problem.

A practical man who has served on both steam and electric power railways gives some practical opinions as to the future of electrification. He says: "The electrification of all traffic lines is certain to come some day. Of course the operators on the steam roads do not believe that, but it is coming. It simply is a question of time. Also it is simply a question of time when the electric lines all will be double-tracked. Perhaps that will come first. The owners of the steam lines, no doubt, understand the value of the traffic handled by the electric lines, but I am quite certain that the men in the operating departments of the steam lines are lacking in appreciation of the extent of that business. The cost of handling business on the electric lines is small, indeed, as compared with the expense of the steam lines. Those fellows, if shown the figures, would say that while figures do not lie, tell the truth. Per ton of freight handled the difference in cost is so great that it seems incredible."

Co-Operation Based Upon Commercial Common Sense.

"Sound commercial common sense and correct business principles, applied to electrical interests, must inevitably destroy the attitude of unrest too often existent between the electrical dealer and contractor and the central-station management."

The Tungstolier Company, of Cleveland, Ohio, in its booklet entitled "Simple Solution of a Central-Station Problem," has worked out and put into effect a plan of co-operation, the fundamentals of which are the elements above quoted.

This plan recognizes fully the very obvious fact that upon the central-station manager devolves the obligation of increasing his load, and points out as clearly that there are methods that he (the manager) may successfully employ which would spell financial ruin to the dealer and contractor.

Rentals, long-time payments, maintenance of equipments, etc., in cases where prospects can be secured in no other way must be assumed by the central-station manager, but it does not follow that he must sacrifice a profit upon the articles sold under these necessarily generous conditions; indeed, there is every reason why he should ask and maintain a price commensurate with the liberal terms allowed.

Electricity is not in its experimental stage. No one (it is quite reasonable to assume) would be without it, if it could be secured and employed on a basis of price even approaching that of other illuminants. It is a most desirable adjunct to any business house or home; it has been on the defensive in competition with other forms of light, only in the one item of cost, which the advent of the tungsten lamp has entirely removed.

Dealers and contractors are as fully alive to the advantages to them of new business campaigns, conducted along sane and aggressive lines, as the progressive business manager is to the value and importance of their friendly co-operation; every additional connection secured by the central station is one more customer added to the field of the local craftsman.

The tungsten lamp has wrought a complete revolution in the public mind, which is keenly alive to its many advantages and possibilities. It has caused attention to be drawn to the difference between glare and effective illumination. All this means revenue to the central station, additional profit to the contractor and an understanding of illumination which must result in mutual benefit to all concerned.

At no time in the history of electric lighting have there been offered so many opportunities to increase the use of electricity as now. Never has the necessity for intelligent co-operation been so urgent. The Tungstolier Company, in this connection, seems to offer a simple and most logical plan.

The central station is furnished with campaign material in the form of folders, form letters and booklets, which, with slight changes to meet local conditions, covers the advertising requirements and special time arrangements under which—only—can be secured the class of business that up to the present it was impossible to secure at all.

This advertising matter is confined to the exploitation by the central-station manager of but three units, viz., one-light, two-light and four-light folding tungstoliers, which are delivered wired complete, ready to hang, thus relieving the central-station manager of the need of maintaining a fixture department, or special wiremen, or of the necessity of investing in more than the immediate demand for units created by his own energy in securing new business. Special appeal in this advertising is made for artistic and scientific lighting; every effort is brought to bear upon the advertising value of modern illumination, properly distributed and softly diffused.

The high standard thus established by the central station as an index of what may be secured by users of old-fashioned methods will induce others to bring their places of business up to the level of their neighbor, or competitor, in illumination; the central station having but three units to offer, must necessarily refer these seekers after more and better light to the local contractor, to whom the entire line of tungstoliers is offered under a dealers' and contractors' agreement that is both unique and original and contains the essence of the co-operative idea. The several clauses in the agreement which entitle dealers and contractors to the maximum discount earned by their joint purchases and those of the central station are as follows:

"The company agrees in further consideration of the character and object of this agreement to permit one or more individuals, firms or corporations to purchase such quantities of tungstolier units as will secure for them jointly with the purchaser the maximum discount which the total amount purchased by them and the purchaser within one year would entitle them, provided that the several parties entering into individual agreements with the purchaser are acceptable to the company.

"It is expressly understood and agreed that neither of the parties participating in this joint purchase of the company's several lines of 'central-station tungstolier units' and fixtures shall in any way be responsible for the acts or indebtedness of any of the other participating parties, and that the co-operative feature of this part of the agreement is designed solely and only to enable the several parties participating to secure the maximum discount on their individual purchases, that the joint sales of the several parties will earn for all.

"The company will furnish the several purchasers a statement showing the total purchases made by all of the participating parties so as to show the discounts that each of the said participating parties is entitled to.

"The company agrees to rebate to the purchaser and to the participating parties the maximum discount provided as soon as the joint sales of the purchaser and the participating parties shall have reached the amount to which the maximum discount applies as per schedule 'A,' after which and until the termination of this agreement the maximum discount will apply to all sales."

This is co-operation in letter and spirit. But the co-operative idea does not stop here.

Realizing what scientific illumination means as an advertising asset and that the public is demanding the best, an illuminating engineering department is at the service of the dealers and contractors (without charge). The company issues a blank, arranged in simple form, upon which may be indicated the dimension of the place to be illuminated, with spaces in which counters, cases, columns and all other necessary data may be shown. This may be forwarded to Cleveland and a full set of plans and specifications will be properly and scientifically worked out and returned, showing all details, with prices, thus enabling the dealer to submit to his customer exactly what he will receive.

The entire scheme is worked out to enable the manager to increase his business and that of the dealer and contractor without either encroaching upon the domain of the other, with the object in view always that the day of scientific illumination is here permanently to stay, and that co-operation will materially benefit all concerned.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, AUGUST 28.—The event of the week has been the total elimination, by the House of Commons, of the clause in the Electric Lighting Acts (amendment) Bill relating to electric wiring, fitting, etc., by municipalities. The bill came up for third reading on Saturday morning toward the end of an all-night sitting and, contrary to general expectation, the clause in question, over which there would undoubtedly have been a conflict with the House of Lords had it been passed, was withdrawn as the only means of securing the passing of the rest of the bill this session, in which there are admittedly some good points. As it is, both the Electrical Contractors' Association and the municipalities prefer the present position to be maintained, as they both now have a possible chance when the matter is raised before private bill committees, whereas a clause in a general act of Parliament would have unduly favored one party or the other once and for all. The varying fortunes of the contending parties in this matter make interesting reading. The Board of Trade, in introducing the clause, wished to give local authorities unrestricted powers, and consequently unrestricted powers to compete with local electric-light contractors, i. e., their ratepayers. The Contractors' Association took the matter up vigorously and succeeded in getting a proviso added to the clause, when the bill was in the House of Lords, to the effect that wiring work could be carried out by municipalities, but only through a contractor. When the bill left the Lords, and came to the House of Commons—which is strongly municipal—this proviso was deleted. Then followed a period of "lobbying" in order to secure the support of members on either side. Further, the Contractors' Association had enlisted the support of a noble lord to move the reinsertion of the proviso when the Commons amendments were sent back to the upper House. This proved the turning point, as, late in the session as it is, a conflict with the Lords would have ended in the bill having to be dropped in its entirety. Rather than do this, the government deleted the clause. The result is that municipalities may only carry out wiring work, etc., where they have special powers from Parliament, and the contractors may be said to have scored.

For the rest, the bill clears up certain inconsistencies and anomalies which have arisen by reason of the antiquation of the Electric Lighting Acts of 1882 and 1888, owing to the progress of the industry. Such a bill was asked for in 1902, but social reforms have occupied the attention of successive governments to such an extent that no time could be found to pass a measure. As it was, the present bill was rushed through at about 4 o'clock in the morning, in the midst of a budget, the like of which has never been known.

One of the two remaining examples of cable traction in England was discontinued this week, viz., the cable cars on Highgate Hill, London. The service has been taken over by the London County Council and will be converted to electric traction on the conduit system. The gradient is very severe, about 1 in 4, and a special type of brake has been designed in connection with the electrical working of the line.

The service of electric tramcars over Blackfriars Bridge, London, will be opened on September 15. It took the London County Council about ten years to break down the prejudice of Parliament and the City Corporation against this line, the House of Lords perpetually throwing out the bill on the opposition of the City Corporation. Eventually, the proposal was passed, and the City Corporation agreed to the widening of Blackfriars Bridge to avoid too great a congestion of traffic. Both sets of rails are laid close to the footpath on one side of the roadway. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 30.—One of the most recent of the French electric plants to use steam turbines is the station now running at Marseilles and owned by the Gas and Electric Company. Curtis turbines are used in the present plant, and these were built at the Paris factory of the Thomson-Houston firm. Three-phase current at 5,500 volts and twenty-five cycles is produced by three turbine-alternators, each unit giving 1,000 kilowatts. There is installed a third turbine-alternator group of the same size, which works together with two rotary converters in order to change the frequency from twenty-five to fifty cycles. A fourth group is formed by a Curtis turbine and a 13,500-volt alternator, which is of larger size than the preceding, and gives 13,500 volts, working at twenty-five cycles. The current at 5,500 volts is used in substations or transformer posts within the city or in the suburbs for lighting circuits, while the 13,500-volt current is used on a separate power circuit, which gives a power supply. The boiler plant comprises twelve boilers, which are heated with coke, this latter coming upon small cars from the adjoining gas works. In the station there are two large switchboards, one for the 5,500-volt circuit and a second for the 13,500-volt current. Exciting current for the alternators is given by three motor-generator sets, whose motors are supplied by transformers from the machine circuits. A fourth steam-engine set is also installed. It is proposed to increase the present plant in the near future so as to give a total capacity of 14,000 kilowatts.

Among the new companies formed at Paris I note the St. Germain Electric Company, the Omnium Electric Installation Company and the Marche and Limousin Electric Company. At Mendon there is formed the Charet Brothers Company, and at Levallois-Perret the storage battery firm of Caillard and D'Hanens. The Schussel and Dumarthenay firm is located at Collonges. The Ezbekieh electric garage at Cairo is occupied with electric automobiles and supplies.

In France there is an electric tramway project on foot in the Jura region for a line running from the locality of Morez to the Swiss frontier. In the region of Haute-Vienne it is proposed to install a system of tramway lines which will include several different sections, and the current will be furnished by a turbine plant located on the Vienne stream.

As regards electric lighting, the town of Arpajon is taking measures to erect a station of some size. A light and power distribution network, having Lisieux as a center, is now under consideration by the municipality. A hydraulic plant is likely to be erected in the neighborhood of Couterne, which will use the power of the Mayenne River in order to supply a number of communes. It is proposed to erect a steam plant at Epinac in order to supply an extensive power network for that region. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, SEPTEMBER 4.—The promoters of the big electric belt line scheme to run a railway from Ottawa through Bell's Corners, Arnprior, Perth, Brockville, Morrisburg, Metcalfe and back to Ottawa, are preparing to turn over to the English capitalists, who have an option on the charter, their interests in the road. The line embraces a run of 251 miles.

The promoters of the development of the Long Sault Rapids, by damming the St. Lawrence River at the head of Barnhart's Island, have been very busy of late buying the property, until they now own the whole of Barnhart's, as well as the south shore of Sheik Island. The project offers cheap power, and will put Eastern Ontario on an equality with those parts of the west of the province served by the power from Niagara Falls.

Development of the hydroelectric power proposition at Indian Chute, on a horseshoe bend of the Montreal River, some eight miles north of Elk City, in the silver mining district of Gowganda, Ont., will be actively proceeded with this season, with the intention of laying down 4,000 horsepower for use at the silver mines, early next summer. Plans call for the erection of a dam at the head of the chute, giving a working head of 42 feet.

The Canadian Light and Power Company, of Montreal, has arranged with J. G. White & Company, of New York, for the engineering, design and supervision involved in the construction of a hydro-electric plant on the St. Lawrence River, near St. Timothee, Quebec. The old Beauharnois Canal passes around the rapids at Grand Island, and the Canadian Light and Power Company has acquired from the Dominion government the right to enlarge, modify and use the canal for power purposes. The present initial development provides for 21,600 shaft horsepower, with such further developments as may be required in the near future. It is estimated that the present initial development will cost about $4,000,000. The Canadian Light and Power Company proposes to do this work by contract on the basis of unit prices. The work of deepening the canal will be begun immediately, and it is expected that the excavation will be pushed ahead as rapidly as possible.

The city of Winnipeg, Man., is demonstrating its venture in the direction of a 60,000-horsepower electric plant by an exhibit at the big fair in Toronto, Ont. There is a tank, 16 feet by 12 feet, with a miniature river and power plant modeled upon what it is expected to look like when completed, next year, at a cost of $3,250,000. The Winnipeg plant is being established on the Winnipeg River, at Point du Bois, seventy-seven miles from the city. When in operation it will be a formidable rival of the Mackenzie-Mann Power Company, which has a present monopoly and sells power at around $35 per horsepower per annum. The

civic plant will, it is figured out, be able to cut charges in two. The Mackenzie-Mann Company offered to sell out to the city, but the company's terms were considered unreasonable. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, SEPTEMBER 4.—For the first time in her history, Winnipeg, Manitoba, was honored by being the meeting place of the British Association for the Advancement of Science. It was the seventy-ninth annual meeting of the organization and was attended by scientists, savants and learned men from practically every civilized country. The United States, Canada and the British Isles were largely represented, while a number of European and Asiatic countries sent their representatives and one came from far-off Ceylon purposely to watch the reports of the chemistry section, expecting an announcement to the effect the experiments toward the manufacture of an artificial india-rubber had been successful. However, the rubber planters will be happy for at least another year, the chemists announcing their experiments had been a failure so far, and natural rubber will continue to supply the demand.

In addition to the many papers read and discussed, the visitors made several trips to points of interest to them. The agriculturalists visited the wheat fields and experimental farms; the engineering section inspected the locks at St. Andrews, Man., the railroad shops, bridges and buildings of interest; the educationalists inspected the schools and colleges, while the electricians and a number of others looked over the sub-station of the Winnipeg Electric Company and also the $3,500,000 power plant being built by the city of Winnipeg at Point du Bois.

Under the leadership of G. W. Bissell, of Michigan Agricultural College, a number looked over the sub-station of the Winnipeg Electric Company on August 31. This principal sub-station receives the high potential of 60,000 volts from the Lac du Bonnet power plant, on the Winnipeg River, at a point sixty-four miles from Winnipeg. This power is transmitted for distribution to various purposes, including seven sub-stations recently erected, the machinery in one of which was turned over for the first time on the day the visit by the scientists was made.

The visitors included a number of members from the general physics section, which has been dealing with the abstruse electrical problems during the Winnipeg meeting, and included a number of men from the United States, England and Scotland whose names are household words in advanced electrical science. All expressed their astonishment and delight at the perfect and up-to-date nature of the plant, hardly expecting to find anything so complete in the far Canadian West. They were interested particularly in the charts showing the lead and were surprised to learn that the peak load the day previous was only 7,500 horsepower out of a total capacity of 27,000 horsepower, and that the heaviest momentary peak had never exceeded 17,000 horsepower.

The potential of 60,000 volts carries banks of fifteen transformers, with a total capacity of 30,000 horsepower, equipped with a secondary side of 2,300 volts. It is then carried to the 2,300-volt busbars, where the taps are taken off which supply Winnipeg's lighting, the capacity being 150,000 incandescent lights. The current is also used to operate the motor generators, which are used for street-railway purposes at a voltage of 575.

The visitors again and again expressed their pleasure at the completeness of the use of electricity in Winnipeg. Professor Dixon, of the Manchester (Eng.) University, was surprised to find in his arrangements for a lecture on the Chemistry of Flame at the Walker Theatre that he had to have gas specially laid into the theatre, which had nothing but electric light.

Another visit of interest was to the site where Winnipeg is constructing a municipal power plant, at an estimated cost of $3,500,000. The work was started a little over a year ago and, it is expected, will be completed within two years. The site is in the immediate vicinity of the Winnipeg Electric Company's generating station, but it was pointed out to the scientists that neither power will be lessened. A visitor from London, Eng., asked what the charge for the power would be when the plant is completed and was informed, "Eighteen dollars per horsepower per annum." The Britisher thereupon took out his notebook and pencil and began to figure. In a minute he said, "Why, a horsepower a year yields as much heat as a ton of anthracite. Your current will be quite cheap enough for a good deal of cooking and heating. Its cleanliness and convenience will offset its extra cost, you'll see." It was further explained to him that the charge of $18 per horsepower allows for all operating expenses, sinking fund and a profit for contingencies.

In the engineering section several papers devoted to electricity were given by men at the head of their profession. Prof. W. M. Thornton and O. J. Williams presented a valuable contribution on the distribution of dielectric stress in three-phase cables. They explained that the problem was to find the voltage gradient at any point in the cross-section of a three-core cable, as used for three-phase currents at any time during the cycle of electrification. The subject was taken up very fully, a number of diagrams and tables being shown, and then the matter was discussed by members of the section.

International electrical standardization was explained by Ormond Higman, chief electrical engineer at the electrical standards laboratory, Ottawa. He said the United States led the way in studying the problem, and in 1899 the American Institute of Electrical Engineers issued their first report. France, Germany and Great Britain followed with their respective rules, in the order named, which, though dealing with practically the same subject, contained certain differences. He mentioned that a somewhat similar paper was read by Sir John Wolfe Barry, K. C. B., at the meeting of the association, held in York, England, three years ago.

In the section devoted to physics, electricity was also discussed from a physical standpoint, the papers being highly technical. R.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

WALLA WALLA VALLEY LINE—Gilbert Hunt, of Walla Walla, Wash., president of the Washington Traction Company, announces that English bankers in London will back the organization in the construction of an electric railway system in the Walla Walla Valley to Kennewick and Pasco, Wash.; also that the company has increased its capital stock from $3,500,000 to $5,000,000. The line projected is from Dayton to Pasco by way of Waitsburg, Walla Walla and Wallula. It is expected that construction work will begin on the valley line the latter part of September. The company has arranged contracts with companies operating boats on the Columbia and Snake rivers for the transportation of freight.

NEW "L" ROAD FOR PHILADELPHIA—The Philadelphia & Suburban Elevated Railroad Company, which has applied for a charter at Harrisburg, Pa., plans to construct an elevated system running north and south in the city of Philadelphia, with spurs into important sections east and west. The company claims to have ample capital to finance the undertaking. So far as perfected, the plans call for twenty miles of main line track, in addition to a number of loops. By a spur to Wayne Junction physical connection is to be made with the tracks of both the Pennsylvania and Reading Chestnut Hill branches. Another spur will connect with the Baltimore & Ohio and Philadelphia, Baltimore & Washington railroads. The incorporators are S. S. Neff, Caspar Wistar Haines, John H. Hawkins, Coates Coleman and A. H. Phillips. The board has organized by electing Mr. Neff, president; Mr. Haines, vice-president; F. T. Finch, secretary; Coates Coleman, treasurer, and Edwin O. Lewis, counsel. An office has been opened at No. 416 Franklin Bank Building, and though the capital announced in the application for the charter is only $1,000,000, it is declared that all the money needed is available and that it will be subscribed in this city exclusively. Mr. Neff has had an extensive experience in steam and electric railway work.

MICHIGAN POWER, GAS AND ELECTRIC LIGHT INTERESTS—The announcement from the secretary of state for Michigan's office that articles of incorporation have been filed by eighteen power companies, with a total paid-in capitalization of $3,200,000, is believed to mean that practically all of the available power sites in Northeastern Michigan have been acquired by eastern interests, which now control gas and electric properties in many cities of the state. While there is nothing in any of the incorporation papers to connect either firm with the companies, it has been reported that Hodenpyl, Walbridge & Co., of New York, and E. W. Clark & Co., of Philadelphia, are interested in Michigan power sites. Fourteen of the new concerns are waterpower companies. Their incorporators are: E. F. Loud and H. K. Loud, of Au Sable, Mich., each of whom holds one share of stock, and L. A. Wood, of New York, to whom are credited the other 998 shares. In the second group of three companies George E. Hardy, of Englewood, N. J., is the heavy stockholder, with W. M. Eaton and J. C. Weadock, of New York, as small holders. These companies and their capitalization are as follows: Saginaw Power Company, $1,000,000; Bay City Power Company, $500,000, and Pontiac Power Company, $200,000. The Charlotte Power Company, with a capitalization of $50,000, is incorporated by George H. Clark, E. Clark and George A. Crawford, of Detroit.

CONSOLIDATION OF MARYLAND ELECTRIC RAILWAYS—With a capitalization of over $100,000,000, having as its object the consolidation under one management of the United Railways and Electric Company of Baltimore, the Annapolis Short Line and the Maryland and Pennsylvania Railway, a proposed big railroad deal is stirring financial districts of Baltimore. The opinion prevails that the Maryland Electric Railways probably will become the holding company for the other properties. Alexander Brown, senior member of the banking firm of Alexander Brown and Sons, who engineered the deal whereby all the trolley systems of Baltimore were united, is said to be the moving spirit in the latest plan for a bigger trolley combination. He is on his way from Europe, and is expected in Baltimore about September 20. The Maryland Electric Railways was organized after the great fire for the purpose of financing the needs of the United, and since has bought equipment, built barns, etc., which it leases to the latter at an annual rental equal to six per cent on actual cost. The United is bound under the terms of the lease to purchase the property of the Maryland Electric Railways subject to a first mortgage for $2,727,000 at an amount sufficient

to pay the principal of the bonds. The Maryland Electric Railways also controls the Annapolis Short Line, having acquired it from Alexander Brown and Sons, who are also the dominant factors in the Maryland and Pennsylvania Railroad, and, in conjunction with Michael Jenkins, George C. Jenkins and John B. Ramsay, absolutely control the United Railways and Electric Company.

LIGHTING AND POWER.

(Special Correspondence.)

ANTLERS, OKLA.—Fort Smith capitalists will put in an electric-light plant at Antlers, Okla.

CEDARVILLE, CAL.—The voters here have decided to organize an electric-lighting district.

IPSWICH, S. D.—Citizens have subscribed $10,000 in stock for an electric-light and power plant. C.

MINOT, N. D.—Nick Hendrickson, owner of Spring Lake Park, is installing a new electric plant. C.

ALAMOSA, COLO.—The Conejos Flouring Mill Company is to install about $15,000 worth of machinery. U.

CANTON, ILL.—The electric-lighting plant at Abingdon has been sold to a new company, and it has been incorporated at $30,000.

DEMING, N. M.—A central-station power plant is wanted at this point and mass meetings have been held with that object in view.

HAWLEY, MINN.—Fairbanks, Morse & Company has secured the contract for the installation of the electric-light and water works system for $13,750. C.

SANDPOINT, IDAHO—The Idaho Power and Concentrating Company has under consideration the building of a concentrating plant on the lake shore. U.

GREENE, IOWA—The Greene Electric Light and Power Company is erecting a new building for the machinery to furnish the town with a day circuit. C.

LODI, CAL.—The municipality has sold bonds to the amount of $126,000 for the purpose of constructing a lighting plant, water system, and sewer system.

GILBERT, MINN—The Home Electric Company, of Eveleth, and the Virginia Light and Water Company, of Virginia, will ask for franchises for electric lighting. C.

RENO, NEV.—The Masonic Mountain Gold Mining Company has been taken over by F. E. Garrett and W. H. Paul, of Denver, who will erect a mill on the ground. U.

BAUDETTE, MINN.—J. G. Robertson, of St. Paul, Minn., has secured the contract for the installation of the electric-light plant and pumping station here for $15,240. C.

BOISE, IDAHO—A thirty-stamp mill is to be erected by the Victory Mining Company fourteen miles up the Boise River. W. A. Hepburn is superintendent of the mine. U.

IDAHO CITY, IDAHO—Fire recently destroyed the supply house at the Boston & Idaho dredge, six miles below this place. A large amount of electrical apparatus and supplies was destroyed. U.

OAKLAND, CAL.—The Central Oakland Light and Power Company, of this place, has given a trust deed to the First Federal Trust Company, of San Francisco, to secure a bond issue of $800,000.

DEADWOOD, S. D.—The controlling interest of the Consolidated Power and Light Company has secured control of the plant and business of the Black Hills Traction Company. About $500,000 is involved in the deal. C.

CARTERVILLE, ILL.—The Interurban Electric Company has been incorporated to operate an electric-light, heat and power plant, with $150,000 capital stock. The incorporators are F. W. Richart, E. E. Denison and H. B. Cassel.

GALESBURG, ILL.—The Abingdon Light and Power Company has been incorporated with a capital of $30,000 to operate an electric-light plant. The incorporators are: J. J. Welsh, A. K. Hardy and Judd Hartzell, of Galesburg.

YREKA, CAL.—The Siskiyou Electric Power and Light Company, which has just completed its nine-mile transmission line from the power house at Fall Creek, is now enlarging the latter to make room for an additional 1,250-kilowatt generator.

BUTTE, MONT.—At a meeting of the Butte and Superior Copper Company at its offices in the Wolvin Building, Duluth, Minn., recently, it was decided to build in Butte, Mont., at once a zinc concentrating plant of 300 tons capacity per day. U.

GRAND FORKS, N. D.—The contract for the installation of the new street-lighting system, comprising 132 lamp posts and accessories, was awarded to the Electric Construction Company, of St. Paul, Minn., at $29,651. The Minneapolis Steel and Machinery Company, Minneapolis, Minn., will furnish the lamp posts. C.

KIRKSVILLE, MO.—W. B. Kinnik and B. C. Davidson have traded the light and heat plant to H. G. Hanson for 960 acres of land in Polk County, Iowa, valued at $72,000. C.

LEAD, S. D.—The Homestake Mining Company is erecting a 5,000-horsepower plant to cost $1,000,000 on Spearfish Creek. It is expected to have it ready by the fall of 1910. C.

COLUMBUS, OHIO—The Mt. Healthy Light and Power Company has increased its capital stock from $10,000 to $45,000. Paul M. Hooven, of Hamilton, is the president of the company.

GREAT FALLS, MONT.—The Great Falls Water Power and Townsite Company has started construction on its big transmission line, which will carry electricity from the power house to the mines and smelters of Butte, a distance of 129 miles. U.

EVANSVILLE, IND.—It is reported that a merger of interests has been effected by the Evansville, Gas and Electric Light Company and the Evansville and Southern Indiana Traction Company. The merger will involve several million dollars. S.

PONDERAY, IDAHO—The Panhandle Smelting and Refining Company, now in the receiver's hands, will resume operations in the near future under new ownership. The capacity of the plant is to be doubled. J. Herbert Anderson is president of the company. U.

FORT WAYNE, IND.—Steps have been taken for the beautification of the central portion of the city by installation of ornamental posts with clusters of lights around the entire court house square. The city will furnish the current from the municipal plant. S.

CHARLOTTE, N. C.—J. W. Menefee, of Saxapahaw, N. C., is understood to be planning the organization of a company to develop a waterpower near Saxapahaw and build a large cotton factory, to be operated by electricity transmitted from the waterpower plant.

MODESTO, CAL.—The La Grange Light and Power Company has finished its substation outside of this city and has completed its transmission line from La Grange to the Modesto substation. A force is now at work connecting up with the Modesto system.

DE PERE, WIS.—The De Pere Electric Light and Power Company has agreed to get 300 horsepower from the Green Bay Light and Power Company, of Green Bay, Wis., and has let the contracts for the necessary transformers and other machinery to be used in taking it. C.

SALT LAKE, UTAH—The Prince of Wales Mining and Development Company, organized as a leading company on the old Prince of Wales mine at Alta, is figuring on the erection of a mill. Fred Schrott is president and E. A. Ulrey is secretary of the company, with headquarters in Salt Lake. U.

GORHAM, N. H.—The power house of the Cascade Light and Power Company, a large, low wooden building situated near the eddy in the Androscoggin River half a mile from the center of this village, was burned Sunday evening, August 8. Loss estimated at $50,000. The plant was built in 1894.

HICKORY, N. C.—G. H. Geitner, A. A. Shuford and others of Hickory are planning the organization of a cotton-mill company. They intend to capitalize the enterprise at $80,000 to begin with, and to operate the plant by electricity transmitted from the Southern Power Company lines to Hickory.

EAU CLAIRE, WIS.—The Wind Electric Power Company has been incorporated by Frank S. Culver, of Madison, and H. T. Lange and F. A. Lange, of Eau Claire, with a capital of $30,000, to manufacture an invention which, through wind power, will generate electricity for lighting purposes on farms. C.

PORTLAND, IND.—The people will be given the privilege of voting on the question of building and equipping an electric-light plant in this city. Much interest has been aroused and this is deemed the best plan to determine the sentiment for municipal lighting. The Biniel Company is now lighting the city. S.

KALAMAZOO, MICH.—The Kalamazoo Valley Hydraulic Power Company, with a capital stock of $300,000, has been organized to do business in this city and other places in this section of Michigan. The headquarters will be in Kalamazoo. The incorporators are E. W. Stone, C. H. Wilkes and H. J. Aldsworth.

BRAZIL, IND.—The Brazil Electric Company and the Terre Haute, Indianapolis and Eastern Traction Company were competitive bidders for the lighting of the city buildings, fire department and the viaduct, in the city. Both bids were the same—6 cents per 1,000 kilowatts—and in consequence both were rejected. S.

CARTHAGE, MO.—The hydroelectric development of High Falls, on the Deer River, a short distance from the village of Copenhagen, is progressing rapidly. The power plant is being erected by S. R. Cleveland, of Watertown, who has been granted

a franchise from Copenhagen to furnish electric street-lighting service.

GUADALAJARA, MEXICO—A meeting of stockholders of the recently organized Chapala Hydroelectric and Irrigation Company has arranged with the Banco Central in the City of Mexico to contract a loan from the Caja de Prestamos of the City of Mexico in connection with the company's proposed irrigation system.

RUTLAND, VT.—The work of raising the dam at East Pittsford by the Rutland Railway, Light and Power Company has been started. The company has bought about twenty-five acres of land bordering on what they already owned around the pond and the dam will be raised about six feet, which will about double the capacity of the reservoir.

GEORGETOWN, COLO.—William H. Goldrick, an electrician and gas engineer of Mineral Wells, Tex., is going over the property of the Golden Glory Tunnel Mining Company, on Saxon Mountain, and will report concerning the construction of the 600-horsepower electric plant which the company purposes erecting on Clear Creek, three miles below Georgetown. U.

DULUTH, MINN.—The contract for the electric light and power wiring in the new Holland hotel has been let to the Duluth Electrical Company. The contract includes a three-panel switchboard with necessary switches and instruments for controlling all lights and motors. The Richardson Electric Company secured the contract for the engines and generators. C.

EDGAR, NEB.—At a special election held here bonds to the amount of $5,000, to purchase an electric-light plant for the town, were carried by a majority of nineteen. Only 125 votes were cast. The town holds an option of $4,000 on the Edgar Light and Power Company. This amount will be paid from the bonds voted and the remaining $1,000 will be used to equip the plant with modern machinery.

CHILLICOTHE, MO., will soon hold an election to vote on the proposition of issuing bonds for the purchasing and improving of the present water works and electric plants, or for the building of a new combined plant. The bond issue will be about $150,000. The Fuller-Coult Company, Chemical Building, St. Louis, Mo., successors to the W. A. Fuller Company, have been retained as consulting engineers.

REDDING, CAL.—An industrial event of great importance to this locality was the receipt here of a carload of pig iron from the electric process iron smelter, at Heroult. It is said to be the first carload of iron ever smelted by electricity on the Pacific Coast. The iron was delivered to a local foundry at $25 a ton, or less than it could be bought for at tidewater. It is pronounced of the finest quality for casting purposes.

ROCHESTER, N. Y.—The Livingstone Niagara Power Company, capitalized at $100,000 to furnish electricity for light, heat and power at Avon, Caledonia, Geneseo, Lima, Livonia, Mendon, Rush and Honeoye Falls, has been incorporated and the papers filed with the secretary of state. The directors are: Charles J. Brown, William S. Riley, W. W. Dake, William L. Likly, Henry G. Strong, William E. Dugan and George Dietrich, all of Rochester.

MONTREAL, CANADA—The Montreal Light, Heat and Power Company has announced the reductions it will make as from October 1 next in the charges for the supply of electric light. This is being done, on five-year contracts only, by increasing the rate of discount to thirty-three and one-third per cent on every account, irrespective of the amount of the bill. Thus the confusion caused under the "primary" and "secondary usage" schedules is done away with.

ALBANY, N. Y.—The public service commission has consented to the consolidation of the Plattsburg Light, Heat and Power Company and the Lozier Light and Power Company under the corporate name of Plattsburg Gas and Electric Company and given its permission that the companies may, pursuant to the terms of the agreement of consolidation, transfer all their property, franchises, etc., to the new corporation formed by such agreement of consolidation.

WORCESTER, MASS.—The Connecticut River Power Company has petitioned the Massachusetts Gas and Electric Light Commission for authority to supply electricity for lighting and power in the city of Worcester, having already secured franchises in some of the towns to the west of the city. On September 9 the Board will give a hearing on the petition and it is expected there will be opposition from the lighting companies which are already supplying the city.

RENO, NEV.—The United Gold Corporation, recently incorporated, has purchased the rights and title of the Sunny Jim Gold Mining and Milling Company and the Tyler Gold Mining Company. Plans are being prepared for the first unit of a mill, which will eventually have a capacity of 1,000 tons a day. G. W. Ebner, assistant cashier of the Crocker National Bank, San Francisco; E. E. Wade, chief clerk of the general passenger department of the Southern Pacific, and other prominent men are interested in the company. U.

ELECTRIC RAILWAYS.

(Special Correspondence.)

BOONE, IOWA—A franchise has been voted to the Iowa Railroad Company. C.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco have bought a four-acre power plant site in this city.

LONG BEACH, CAL.—An ordinance has been adopted granting a franchise in this place to the Pacific Electric Company of Los Angeles.

SAN BERNARDINO, CAL.—Fred Durham, of Redlands, has applied to the city council for additional electric railway franchises in this city.

NORTH YAKIMA, WASH.—The Yakima Transportation Company will extend its line through Fruitvale. The franchise is for about two miles. U.

ADEL, IOWA—The indications are that the route of the proposed Des Moines, Council Bluffs & Western Electric Railway will pass through this town. C.

SAN DIEGO, CAL.—The South Park and East Side Railway Company states that its line has been sold to the San Diego Electric Railway Company.

PACIFIC GROVE, CAL.—E. H. Kramer, president of the Monterey County Gas and Electric Company, owners of the Monterey-Pacific Grove Electric Railway line, states that the company will double-track and standardize the line.

LA CROSSE, WIS.—William Edmunds, expert electrician, of Boston, Mass., has been inspecting the plant of the La Crosse City Railway Company with a view to its purchase by eastern capitalists. C.

MINNEAPOLIS, MINN.—Construction on the Arrow line, an electric railroad between the Twin Cities and the head of the lakes, is being pushed. It now has nearly forty miles of grading completed. C.

RED OAK, IOWA—W. L. Sontag, of Evansville, Ind., builder of the Evansville interurban railway system, has been employed, with offices in this city, to build the Des Moines & Red Oak interurban. C.

CHARLESTON, S. C.—A commission has been issued to the Greenwood and Augusta road with a capital of $1,200,000. The incorporators are Henry Briggs, Frank Hammond, J. P. Charles and two New Yorkers.

HAMILTON, IOWA—Work has been commenced on the construction of a coal road to Hamilton, Iowa, which is expected to ultimately form the main line of the interurban between Ottumwa and Des Moines. C.

PEORIA, ILL.—The ordinance before the city council for the franchise of the Peoria & Galesburg interurban railway is being redrafted by the corporation counsel and will shortly be again presented to the council for action. V.

WENATCHEE, WASH.—A move is on foot to build an electric railway from here to Waterville and from here to Leavenworth. George H. Ellis, E. M. Tipper and W. R. Powell compose the committee in charge of the matter. U.

DEADWOOD, S. D.—The Consolidated Electric Light Company has purchased the lighting plant on Redwater and the auxiliary plant here of the Black Hills Traction Company, the consideration being in the neighborhood of half a million dollars. C.

TOLEDO, OHIO—According to announcements given out by the officials of the company, the Lake Shore Electric is fitting up repair shops at Sandusky, where after October 1 all "bad order" cars will be sent for proper attention. The shops at Fremont, Ohio, will be discontinued. H.

BOISE, IDAHO—James Adams, a capitalist of Boston, is the chief promoter of an enterprise for the building of an electric line from the business center of Boise across the Eighth Street bridge and running out on the bench for several miles and then in a westerly direction to the town of Kuna. U.

LOS ANGELES, CAL.—The Los Angeles-Pacific Company has arranged with the Southern Pacific Railway Company to lease eight miles of the latter company's steam railway track between Los Angeles and Sentous station. The leased track will be converted into a trolley line for the use of the beach passenger cars of the Los Angeles-Pacific Company's system.

OTTAWA, CAN.—A new electric railway is to be built from Morrisburg, Ont., to Ottawa, Ont. The power plants will be at Morrisburg and Billings Bridge, Ottawa. The company has $1,000,000 corporate capital. Another line contemplated, called the Belt Line Electric Railway, covers practically the same route, and whichever line begins work first will get the right-of-way.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CRAB ORCHARD, NEB.—The Crab Orchard Telephone Company has been incorporated with a capital of $20,000.

BROKEN BOW, NEB.—The Broken Bow Electric Light Company has been incorporated with a capital of $25,000.

GREELEY, COLO.—The Colorado Telephone Company intends installing an exchange here with a capacity of 9,000 lines.

DES MOINES, IOWA—The Iowa Telephone Company has purchased the business of the Mutual Telephone Company for $600,000.

HOQUIAM, WASH.—The Pacific States Telephone and Telegraph Company will expend about $12,000 this year in improvements here. U.

MINNEAPOLIS, MINN.—The chief of police has recommended the levy of $8,500 to pay for the installation of a new police signal service. C.

CRAB ORCHARD, NEB.—The railway commission has authorized the Crab Orchard Telephone Company to issue capital stock to the amount of $20,000. C.

VALLEJO, CAL.—The Pacific States Telephone and Telegraph Company has appropriated $27,000 for the renewal of the company's toll lines in the Napa and Vaca valleys.

BRIDGEPORT, CAL.—A. S. Bryant, owner of the Bridgeport telephone line, has bought out the Copper Mountain and Mono Lake line and is now repairing and rebuilding it.

WEBSTER CITY, IOWA—It is said that the Martin Telephone Company will secure a controlling interest in the Hamilton County Telephone Company and the Iowa Telephone Company, in this vicinity. C.

ONTARIO, ORE.—The Ontario Independent Telephone Company has just elected permanent officers. H. B. Grauel is president and J. Prinzing, secretary. The company expects to have its line built and in operation within three weeks. U.

MONTICELLO, IND.—Articles of association have been filed in the state auditor's office by the Home Telephone Company, of Jasper, Newton, Pulaski and White counties. Capital stock, $50,000. Incorporators, Frank Welsh, F. E. Babcock and George W. Casey.

DETROIT, MICH.—It is announced that the Michigan State Telephone Company, which is to list its securities on the Chicago Stock Exchange, has named the Harris Trust and Savings Bank as its Chicago agent. The Farwell Trust Company was selected as registrar.

PITTSBURG, PA.—The West Virginia Western Telephone Company, with headquarters at Parkersburg, W. Va., has been purchased by the National Telephone Company, of Wheeling, which recently acquired control of the Pittsburg & Allegheny Telephone Company, of Pittsburg.

BOZEMAN, MONT.—The Rocky Mountain Bell Telephone Company has closed contracts with the Montana Eastern Telephone Company, of Glendive, and Paul Van Cleve, of Glendive, by which all the territory in the Yellowstone Valley, east of Billings, will be in the Bell long-distance system. C.

DES MOINES, IOWA—The Iowa Telephone Company has bought the majority of the stock of the Mutual Telephone Company, of Des Moines, held by Charles and Clyde E. Brenton, bankers, of Dallas Center, Iowa, for $600,000. The value of the property owned by the Mutual company is valued at $1,100,000. C.

SAN FRANCISCO, CAL.—Judge Seawell, of the Superior Court of San Francisco, has decided in favor of the Western Union Telegraph Company in its suit against the Postal Telegraph Company and the Commercial Pacific Cable Company to enjoin the latter companies from making an extra charge of $5 on all cablegrams handed in by the Western Union Telegraph Company for transmission over the cables of the Commercial Pacific Cable Company.

MEMPHIS, TENN.—The Cumberland Telephone and Telegraph Company is planning to expend more than $100,000 in Memphis territory before the beginning of the new year. The district extends for about two hundred miles in either direction from Memphis, Tenn. Work has already begun on several new lines which will give Memphis business connections with considerable new territory, which has not before been reached from that office. A part of the line between Memphis and Jackson, Miss., is to be reconstructed. The last link is now under construction between Tutwiler and Lake Cormorant, Miss. A new line is also being built in Mississippi, between Winona and Starkville, a distance of about seventy-five miles. A new line will also be built from Union City to Jordan, Ky., and another from Selmer to Savannah, Tenn., by way of Stanton and Adamsville.

ELECTRICAL SECURITIES.

There has been quite the usual to-and-fro movement of prices, with little animation in either direction. All over the country there is a strange mixture of confidence and apprehension, with business improving every minute in many lines, but overshadowed by a fear that the return of activity is too good to be true. This is but the natural reflection of a dearly purchased conservatism, and as improving conditions continue, doubt and fear will give way to general optimism. Among the interesting things noted in tractions last week was the announcement of an increase of 4.46 per cent in the daily average passenger traffic on the Northwestern Elevated, Chicago, during August. In the same month the gross earnings of the Brooklyn Rapid Transit Company increased $186,000, an increase of $6,000 per day. This makes the increase in earnings for the first two months of the new fiscal year $375,520.

On July 1 last Pacific Telephone Company had a total of 311,418 subscribers' stations, an increase of 21,747, or 7½ per cent, since the first of the year.

The Northwestern Elevated Company of Chicago's annual meeting will be held September 20. Books close September 9 and reopen September 21.

DIVIDENDS.

Brockton & Plymouth Street Railway Company; semiannual dividend of $3 per share on the preferred stock, payable September 15 to stockholders of record September 7. Chicago Telephone Company; regular quarterly dividend of two per cent, payable September 30 to stock of record September 25. Interborough Rapid Transit Company; regular quarterly dividend of two-and-one-fourth per cent, payable October 1 to stock of record September 18. Oklahoma Gas and Electric Company; regular quarterly dividend of one-and-one-fourth per cent on the common stock of the company, payable September 15 to stockholders of record September 15. Philadelphia Traction Company; regular semiannual dividend of $2, payable October 1 to stock of record September 8. Railways Company General; dividend of ten per cent, payable September 15 to stock of record August 31. This is the initial dividend on the stock of the company. San Diego Consolidated Gas and Electric Company; regular quarterly dividend of one-and-one-fourth per cent on the common stock of the company, payable September 15 to stockholders of record September 15.

NEW YORK.

	Sept. 6.	Aug. 30.
Allis-Chalmers common	15⅜	15
Allis-Chalmers preferred	52½	50½
Amalgamated Copper	84	83
American Tel. & Cable	*80	*80
American Tel. & Tel.	141¾	139
Brooklyn Rapid Transit	78⅞	78⅝
General Electric (ex-dividend)	166	165¾
Interborough-Metropolitan common	14¼	14
Interborough-Metropolitan preferred	46½	46½
Kings County Electric	130	131
Mackay Companies (Postal Telegraph and Cables) common	82½	81
Mackay Companies (Postal Telegraph and Cables) preferred	74½	74½
Manhattan Elevated	141	141½
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	138	137½
U. S. Steel common	80	75¼
U. S. Steel preferred	127¼	124
Western Union	75⅜	73
Westinghouse common	85½	84¾
Westinghouse preferred	130	120

*Last price quoted.

BOSTON.

	Sept. 6.	Aug. 30.
American Tel. & Tel.	141¾	139
Edison Elec. Illuminating	256	253
General Electric (ex-dividend)	166	165¾
Massachusetts Electric common	17	15
Massachusetts Electric preferred	78	74
New England Telephone	136½	..
Western Tel. & Tel. common	11½	11
Western Tel. & Tel. preferred	90	89

PHILADELPHIA.

	Sept. 6.	Aug. 30.
American Railways	46	46¾
Electric Company of America	12¼	12¼
Electric Storage Battery common	63	68½
Electric Storage Battery preferred	63	68½
Philadelphia Electric	12⅝	12
Philadelphia Rapid Transit	30	30
Philadelphia Traction	90¾	90½
Union Traction	53	53¼

CHICAGO.

	Sept. 6.	Aug. 30.
Chicago Railways, Series 1	110	108
Chicago Railways, Series 2	37¼	37¼
Chicago Subway	17¾	19½
Chicago Telephone	135	135
Commonwealth Edison	120	120½
Metropolitan Elevated common	15⅛	15⅛
Metropolitan Elevated preferred	49	49
National Carbon common	95	95
National Carbon preferred	119	119

PERSONAL MENTION.

CLAIRE F. BEAMS has severed his connections with J. G. White & Company, New York, to accept the position of general manager of the Cobalt Power Company, Cobalt, Ont., Can.

JOSEPH F. BECKER, of the Edison Illuminating Company of Brooklyn, N. Y., has resigned to become superintendent of the sales department of the United Electric Light and Power Company, of New York city. Mr. Becker enters on his new duties on September 15.

GLENN MARSTON sailed for Glasgow, Saturday, September 4, on the steamship Columbia, for the purpose of investigating the relations of public service companies to the public, their practical restrictions, and regulation through commission and otherwise, in England and on the continent.

H. M. BYLLESBY, of Chicago, was one of the old-time friends of Mr. Edison to attend the banquet in his honor given by the Association of Edison Illuminating Companies, at Briarcliff Lodge, N. Y., last week. Mr. Byllesby renewed acquaintance with a host of electrical friends on that occasion.

HUGH J. McGOWAN, president of the Indianapolis Traction and Terminal Company and the Terre Haute, Indianapolis and Eastern Traction Company, has returned to this city after a year's sojourn in the old country. Mr. McGowan went abroad for his health and returns almost completely restored to his usual good health. S.

JAMES B. WALKER, assistant secretary to the New York Public Service Commission, left last week on his first vacation since the organization of the commission. Mr. Walker will spend three weeks at Lake Skaneateles and at the end of that period will go to Syracuse for one week to assume charge of an exhibit the Public Service Commission will have at the state fair.

HAROLD K. WELD, of the engineering department of the Chicago Telephone Company, has resigned his position to become a member of the sales department of the McRoy Clay Works, manufacturers of underground conduits, Rookery Building, Chicago. Mr. Weld's work has been along the engineering side of underground conduit construction for some time past, and his new work will therefore be along congenial lines.

CHARLES BAKER, who for many years was one of the erecting engineers with the Goodman Manufacturing Company of Chicago, has formed a partnership with Grant Ford and opened an office in Room 701, Chicago Opera House Building, 112 Clark Street, Chicago. The firm of Ford & Baker will do general consulting engineering work, specializing on power plant design, erection and testing. Mr. Baker has had extensive experience in the electrical equipment of coal mines and particularly in the installation of their power plants.

DR. LOUIS COHEN has resigned his position as physicist and librarian of the Bureau of Standards, Washington, D. C., and has received an appointment as mathematician and experimental engineer for the National Electrical Signaling Company. This is the company that controls the Fessenden wireless telegraph system and is designing a 3,000-mile station for the government at Washington, D. C. Doctor Cohen is a graduate of Armour Institute of Technology, Chicago, in the class of 1901. He spent one year subsequently at the University of Chicago and two years at Columbia University, New York, in graduate work. At the latter institution he was engaged in special research work with Doctor Pupin. After leaving Columbia Doctor Cohen took the position with the Bureau of Standards that he has just left. During most of the four years that he was in Washington he was also assistant professor at George Washington University. Doctor Cohen is the author of a large number of technical papers that have appeared in the Bulletin of the Bureau of Standards, in the Proceedings of the American Institute of Electrical Engineers and in several technical journals.

PROPOSALS.

POST OFFICE, JACKSON, MICH.—Sealed proposals will be received at this office until October 7, 1909, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of an extension, remodeling, etc., to the United States Post Office, Jackson, Mich., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at Jackson, Mich., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, BELFAST, ME.—The Supervising Architect will receive sealed proposals on October 14, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the U. S. Post Office and Custom House, Belfast, Me., in accordance with drawings and specification, copies of which may be obtained from the custodian, at Belfast, Me., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE ROCHESTER MACHINE TOOL WORKS, Rochester, N. Y., is issuing a catalogue descriptive of their Acme engine.

THE LIBERTY ELECTRIC MANUFACTURING COMPANY, Pittsburg, Pa., is distributing a pamphlet describing its cellulose and non-cellulose filament lamps.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., announces that it will open an office in the Ford Building, Detroit, Mich., on or about September 10. Charles W. Cross will be the manager of this branch.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., announces that it has appointed the Atlanta Brokerage Company, Atlanta, Ga., as its sales agents for the state of Georgia, also that it has appointed as its agents for the states of Oregon and Washington the Montilius Price Company, Seattle, Wash.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has published an illustrated folder (Bulletin 115) describing the battery of "Chloride Accumulator" cells, etc., as installed in the Hudson Terminal Building, New York. This is one of an interesting series of bulletins on the application of storage batteries to isolated lighting and power plants.

THE TUNGSTOLIER COMPANY, Cleveland, Ohio, announces the incorporation of the Tungstolier Company of Canada, Limited. The officers of the company are E. J. Kulas, president; R. B. Basham, vice-president and general manager; W. H. Wissing, secretary, and C. F. Koepge, treasurer. R. B. Basham was formerly general western manager of the parent company in Chicago.

THE FORT WAYNE ELECTRIC WORKS COMPANY, Fort Wayne, Ind., has plans under way for the construction and equipment of a four-story addition to its electric-lamp factory. The improvement and extension will involve the expenditure of a half million dollars. When completed the company will manufacture on an extensive scale the Wood new style magnetic arc lamp, which is said to have successfully withstood every test. S.

MATHIAS KLEIN & SONS, Chicago, the well-known manufacturers of electricians', linemen's and contractors' tools, announce that, owing to the revision in the Chicago house numbers, all mail should hereafter be addressed to numbers 562 and 564 West Van Buren Street. The company is doing an excellent business, and has recently appointed Harmon S. Salt, 114 Liberty Street, New York, as its eastern agent, and Otis & Squires, 155 New Montgomery Street, San Francisco, as its Pacific Coast agents.

THE EXCELLO ARC LAMP COMPANY, New York, N. Y., announces that it has received an order for forty-four lamps from the Minnesota State Agricultural Society. These lamps are to be used in extending the outdoor lighting arrangement which this society began last year, when it purchased forty-two lamps from the Excello company for the illumination of the live-stock yards, and the lighting of the field upon which was enacted the spectacular reproduction of the Fort Ridgely massacre.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has issued Bulletin 351 (superseding Bulletin 321) on Triumph induction motors. This describes, with the aid of several illustrations, the twenty-five horsepower three-phase induction motor, both the mechanical details and the efficiency, speed regulation, temperature, power-factor, and other considerations. Special types of motor, as the slip-ring, back-geared, and vertical motor are described; also the applications of all the types. A chapter on starting devices is also given.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has entered suit in the United States Circuit Court at Buffalo, N. Y., under date of July 14, against the United States Lighting and Heating Company and the National Battery Company, alleging infringement of a patent owned by the Electric Storage Battery Company for the manufacture of storage battery plates. The Electric Storage Battery Company announces the purchase of a large number of its car-lighting equipments by the Atchison, Topeka & Santa Fe Railroad.

THE MECHANICAL AND ELECTRICAL MANUFACTURING COMPANY, 54 North Desplaines Street, Chicago, has published a complete price list of its electrical specialties. These comprise weatherproof pendant and wall sockets, outlet-box and sign or festoon sockets, combined outlet box covers and open or weatherproof sockets, as well as various outlet-box covers, brushings, receptacles, etc. The combination outlet-box covers and sockets are made in a great variety of forms and materials, the weatherproof types being particularly in great demand.

THE HEMINGRAY GLASS COMPANY advertises in this journal, giving its office address as Covington, Ky., and factory address at Muncie, Indiana. An English reader of this journal sent for prices and catalogue on Hemingray insulators, addressing the letter as follows: Hemingray Glass Company, Covington, Ky., Muncie, India. The letter was mailed from Birming-

ham, Eng., on June 10, and finally reached its destination in Covington, Ky., on August 5, after a circuitous trip through the Orient. The envelope is literally covered with foreign postmarks.

THE CRESCENT COMPANY, Chicago, Ill., announces that it has taken the agency for the American Conduit Manufacturing Company, Pittsburg, Pa., makers of American rigid iron conduit and "wireduct" non-metallic flexible conduit; also the agency for the Lowell Insulated Wire Company, Lowell, Mass., makers of lamp cords, telephone wire and all kinds of rubber-insulated wire. The Crescent Company will carry at 106 South Clinton Street, Chicago, a complete stock in each of the above lines so as to insure prompt delivery of rush orders.

THE WESTERN ELECTRIC COMPANY, New York and Chicago, is distributing a bulletin illustrating and exploiting the Sunbeam tungsten miniature lamp for use on voltages between one-and-one-half and twenty. These lamps vary in efficiency from 0.9 watt per candlepower to 1.33 watts per candlepower, and are particularly desirable for use in automobiles, flashlights, signs, dental, optical and surgical instruments, and, in fact, any place where battery or low-voltage power circuit lamps are used. A copy of this bulletin No. 8-A may be obtained from the Western Electric Company's nearest house.

THE RATHBONE & PANIGOT COMPANY, 54 Clyde Park Avenue, Grand Rapids, Mich., reports rapidly increasing popularity of its electric open fireplaces and electric radiators. A large number of central stations have found that they are an effective weapon in fighting gas competition. The electric radiators, particularly, have met with much favor, as they are not only a very cheerful heating medium, but absolutely eliminate the vitiation of the air and the positive danger and discomfort from leaky gas radiators. Electric fireplace designs of very tasteful character have been made and have added materially to the line of electric heating appliances this company handles.

THE HOPPES MANUFACTURING COMPANY, Springfield, Ohio, has secured an order for two 30,000 horsepower open heaters for the Transit Development Company, of Brooklyn, N. Y., and one 25,000 horsepower heater for the Metropolitan Street Railway Company, New York, N. Y. Both of these heaters will take the place of closed heaters, and the latter will take the place of the secondary heater, about which there was so much discussion at the time of its installation. It is stated by the company that there will be a saving of one dollar an hour in water alone in the Metropolitan plant. These heaters are made in smaller sizes for plants of smaller capacity. Full information may be secured upon request.

M. O. PAYNE, vice-president of the Schott Engineering Company, Chicago, is receiving the congratulations of his many friends for securing the contract from the Yakima Central Heating Company, North Yakima, Wash., for a central-station steam-heating system, which is to be built in connection with the Yakima artificial-ice and cold-storage plant. The contract amounts to about $100,000, and includes the power house equipment, as well as about 10,000 feet of street mains. Immediate construction will be begun, and the plant is expected to be in operation about November 1.

THE MOORE ELECTRICAL COMPANY, Newark, N. J., has closed a contract for installing the Moore light in the new building of the Emigrant Industrial Savings Bank at 43-51 Chambers Street, New York, of which Raymond F. Almirall is the architect. This installation is to consist of forty-two tubes of the Moore light and approximately 4,500 feet of glass tubing. The lighting is designed to produce useful illumination at a low-current consumption and to make extremely pleasing lighting effects. The building is to be sixteen stories high, and will be built in two sections, the first half to be completed within six months. It is probable that several other banking houses will adopt the Moore light in the near future.

THE KIMBLE ELECTRIC COMPANY, 1121 Washington Boulevard, Chicago, Ill., is distributing a new catalogue devoted to its variable-speed, single-phase, alternating-current motors. This company has ready for the market a fine line of motors for ventilating fans, printing presses, static machines, forge-blowers, church organs, air compressors, and, in fact, any standard or special application. One of the latest things this enterprising company has done is the sending of a strong letter to the central-station industry calling attention to the valuable features of variable-speed, single-phase, alternating-current motors in increasing the day load of central stations. This literature should be secured by everyone interested in this subject.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF CAR-LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Huntington, second vice-president and manager Washington Water Power Company, Spokane, Wash.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, J. W. Brennan, Edison Illuminating Company, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Frick Building Annex, Pittsburg, Pa.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 115 Adams Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Annual convention, Atlantic City, N. J., September 14-16.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER. ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary and treasurer, A. P. Biggs, Detroit, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Frank M. Tait, Dayton, Ohio.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Addison County, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 382 Ohio Street, Chicago, Ill. Annual convention, Detroit, Mich., October 26-28, 1909.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 24, 1909.

932,426. TROLLEY-REPLACER. Walter M. Austin, Swissvale, Pa., and Samuel C. Cooper, Johnstown, N. Y., assignors of one-third to said Cooper, one-third to Philip Keck, and one-third to Sidney E. Trumbull, Johnstown, N. Y. Filed May 3, 1907. Renewed September 3, 1908. Has means for automatically projecting replacer into operative position, and fluid pressure means for resetting the replacer.

932,433. CONVERTLET. Cecil R. Bold, Charleston, S. C. Filed April 10, 1909. Openings through the end sections form outlets for wires, and a detachable cover affords access to the interior.

932,441. ELECTRIC-WELDING MACHINE. Alvin E. Buchenberg, Toledo, Ohio, assignor to the Toledo Electric Welding Company. Filed August 19, 1908. Describes a form of electric transformer welding machine.

932,459. METHOD OF REDUCING AND MELTING OXIDES AND THE LIKE. Otto Frick, Sheffield, England. Filed April 19, 1907. The material forms a continuous conductor of high-resistant material between electrodes connected to a source of alternating current. The reduced metal sinks into an annular crucible and is melted by an induced current therein.

932,469. ELECTRIC FURNACE. John A. Hay, London, England, assignor to American Electric Furnace Company. Filed June 19, 1909. Has a passage through the crucible or hearth for limbs of the core and a winding, and a metallic shield for the passage has a radiation surface of greater area than that of the passage.

932,481. CURRENT-INTERRUPTER FOR ELECTRIC CIRCUITS. Frederic W. Lord and Frederic W. Erickson, New York, N. Y. Filed April 27, 1907. As a means for dissipating a "following-arc," there are: a circuit including spaced opposing terminals, a rotor extending into the arc-gap between the terminals and having conducting segments adapted to be rapidly and successively brought within the arc-gap, and means for varying the position of the terminals relative to the rotor during the movement of the latter.

932,505. ELECTRICAL SIGNALING SYSTEM. Frank M. Slough, Elyria, Ohio, assignor to The Dean Electric Company. Filed July 10, 1906. Includes means for producing a periodic signaling current, a separate synchronizer therefor, a common source of electric energy and means whereby the operation of such synchronizer tends to maintain constant the frequency of such signaling current.

932,511. TROLLEY. Norman W. Storer and Theodore Varney, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed October 18, 1905. Describes a form of side-rail trolley.

932,519. TROLLEY FOR ELECTRIC VEHICLES. Theodore Varney and Norman W. Storer, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed May 23, 1908. Comprises a pantograph or lazy-tongs structure, a main bow contact shoe supported at the upper end of the structure, auxiliary contact shoes, and means dependent upon the speed of the vehicle for forcing an auxiliary contact shoe into engagement with the conductor.

932,523. INSULATOR FOR THIRD RAILS. Eugene M. Weaver, Ozone Park, N. Y. Filed September 10, 1908. A metallic standard supports an inverted cup-shaped insulating support for the rail.

932,537. DYNAMO-ELECTRIC MACHINE. Abe L. Cushman, Concord, N. H., assignor of one-half to Benjamin A. Kimball, Concord, N. H. Filed February 15, 1908. Comprises a frame for field and commutating magnets including a main core projecting from the yoke of the frame having an extended pole shoe, and a commutating magnet core beside the main core and projecting from the yoke to the outer side of the extended pole shoe, a commutating winding on the commutating core in series with the armature circuit, and a main field magnet winding in shunt with the armature circuit and inclosing both the main magnet core and the commutating magnet core and winding.

932,538. TROLLEY. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed November 8, 1907. Comprises a supporting frame having a number of cross-rods, end castings in which the rods are mounted, side bars rotatably mounted near the extremities of two of these rods and provided with gear segments which mesh with each

other, and twin contact shoes rotatably mounted upon a third rod.

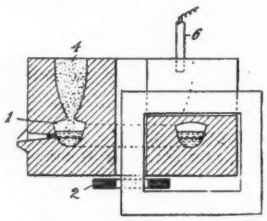
932,539. CURLING-IRON HEATER. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr. Filed August 10, 1908. Comprises a heating chamber, a resistance coil in connection therewith, a metallic part within the chamber having electrical connections, a space between adapted to be occupied by the iron or like device to make the electrical connection, and a spring for holding the iron in place.

932,541. ABNORMAL POTENTIAL-DISCHARGING AND ARC-DISRUPTING DEVICE. Frederic W. Erickson and Frederic W. Lord, New York, N. Y. Filed April 27, 1907. In an abnormal-potential discharging current path having spaced terminals therein, and also having intervening current-conducting means intermediate the terminals and spaced therefrom, an arc-dissipating device has a number of disks extending within the current path intermediate the terminals and the intervening current-conducting means, and a motor is provided for imparting simultaneous movement to each of the disks.

932,545. TELEPHONE ANTISEPTIC MOUTHPIECE. Jacob M. Haff, Los Angeles, Cal. Filed April 24, 1907. An antiseptic disk of fibrous material is included in a lining for the mouthpiece.

932,554. TROLLEY. Ray P. Jackson and Christian Aalborg, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed April 28, 1906. Describes a fluid-controlled pantograph trolley.

932,557. SWITCH-HOOK-CONTROLLING DEVICE. Mose M. Kahn, Louisville, Ky. Filed October 29, 1908. Comprises a bracket for attachment to a transmitter support, an arm pivoted by one end to the end of the bracket, a cylindrical weight connected with the other end of the arm, a grip on the weight, and means for fixing the arm with respect to the bracket.



932,459.—METHOD OF REDUCING AND MELTING ORES AND THE LIKE.

932,582. RAILWAY BLOCK SYSTEM. William L. Rummel, Sioux City, Iowa. Filed April 11, 1908. Plates extending from the engine engage contacts to close the circuit.

932,613. ARC-LAMP CUT-OUT. Laban E. Jones, Anaconda, Mont. Filed January 28, 1909. Describes a contact system in connection with an arc-lamp hanger and lifting mechanicsm.

932,616. BRUSH FOR DYNAMO-ELECTRIC MACHINES. Earle R. Knight, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed February 7, 1906. The brush holder guide plate is riveted only to one side of the brush, the plate being bent over the end of the brush.

932,621. ELECTRIC LAMP. David D. Lockwood, Bridgeport, Conn. Filed January 7, 1909. Describes an adjustable bracket, etc., for an electric lamp.

932,625. INDUCTION-MOTOR. Emil Mattman, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed September 5, 1905. Comprises a shaft slotted at one end, a number of collector rings carried by the shaft, lugs extending inwardly from said rings through said slots, winding terminals connected to the lugs, and an axially movable short-circuiting sleeve mounted on the slotted portion of the shaft and having openings which receive the lugs and permit axial movement of the sleeve relative to the same.

932,637. CONTAINER FOR SECONDARY BATTERIES. Emil L. Oppermann, London, England. Filed August 22, 1908. A sheet-metal tank is lined with insulating material which extends also over the outwardly protruding lip around the tank top, and a rubber washer is interposed between the lip and a lid for the tank.

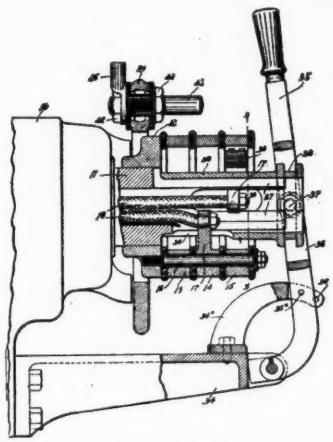
932,641. DYNAMO-ELECTRIC MACHINE. William D. Pomeroy, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed June 16, 1906. Comprises a stator consisting of a frame with integral bearing-housings, a rotor, a shaft on which the rotor is mounted, bearings for the shaft, wedges carried by the housings for supporting the bearings, means for adjusting the wedges to adjust the shaft vertically, and means for adjusting the bearings laterally.

932,651. TROLLEY. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 16, 1906. Describes a form of double pantograph trolley with pneumatically controlled contact shoe, etc.

932,652. TROLLEY FOR ELECTRICAL VEHICLES. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 5, 1907. A bow frame has end castings and side strips, and a number of contact plates mounted thereon in end-to-end engagement along diagonal lines.

932,653. TROLLEY. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 5, 1907. A trolley for electric railways comprises a supporting frame and a galvanized steel contact plate having an upward curvature from end to end and a longitudinal groove or recess.

932,654. TROLLEY. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. Comprises a supporting frame having a resilient outer extremity the ends of which are bent inwardly into alinement with each other, bearing blocks rotatively adjustable on the alining ends of the frame, and a



932,625.—INDUCTION MOTOR.

pair of oppositely disposed resilient bow contact shoes secured to the bearing blocks.

932,655. TROLLEY FOR ELECTRIC VEHICLES. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 22, 1908. Comprises a double pantograph supporting structure and a contact member secured thereto, means for expanding the supporting structure, and wind-vanes pivotally suspended from the ends of the structure.

932,656. TROLLEY FOR ELECTRIC VEHICLES. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 7, 1908. Comprises a supporting structure and a number of resilient contact strips disposed parallel to each other and in the same horizontal plane under tension.

932,661. DIRECT-CURRENT TURBO-GENERATOR. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed November 3, 1906. Describes details of the armature and commutator.

932,662. ROTOR CONSTRUCTION. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed January 31, 1907. The rotor of a dynamo-electric machine comprises a shaft, a core mounted on the shaft, a winding carried thereby, a collector ring, and means for connecting the winding and collector ring comprising a plurality of straight rods or bars electrically connected in series and extending parallel to the rotor axis.

932,707. ELECTRIC LOCOMOTIVE. William F. Hunt, New York, N. Y., assignor to C. W. Hunt Company. Filed November 21, 1907. In combination with an electric locomotive and its motors is a storage battery carried by the locomotive, also plural conductors external to the locomotive, a three-armed trolley carried by the locomotive, a contact on the trolley connected to one side of the battery and motors, two contacts carried by the trolley and connected in parallel to the other side of the battery and motor, and connections between the battery and the motors.

932,714. AUTOMATIC CONTROL DEVICE FOR ELEVATORS. Louis J. Milke, Baltimore, Md. Filed August 11, 1908. Levers connected with valve and cylinder devices are provided with armatures co-operating with electrical coils so that one piston ascends as the other descends, thereby closing a gate valve in the main supply pipe which connects with a storage tank.

932,753. CALL-BOX. Henry S. Bullock, Jr., New York, N. Y., assignor to American District Telegraph Company. Filed January 17, 1907. A signal transmitter comprises transmitting means for transmitting successively and in alternation two different signals, mechanism arranged to operate said transmitting means a greater or less number of times at will, and contact means for closing a shunt connection around the transmitting means, arranged to close the shunt connection during the last transmission, by the transmitting means, of the first of the signals.

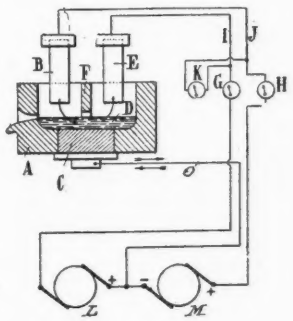
932,773. ELECTRIC-ARC LAMP. Joseph B. Fournier, Paris, France. Filed November 21, 1903. Renewed June 7, 1909. Describes an arc-lamp regulator.

932,775. ELECTRIC THERAPEUTIC INSTRUMENT. Charles W. Gaston, Fresno, Cal. Filed June 5, 1909. Comprises a tubular body open at its ends and exteriorly grooved, wires of opposite metals arranged alternately in the grooves of the body and having end portions extending within the body, and end closure plugs removably arranged in the ends of the body and retaining the wires in position.

932,792. SWITCH FOR ELECTRIC LAMPS. Edward A. Lefebre, Jr., and William I. Miller, Brooklyn, N. Y. Filed January 13, 1909. A lamp socket has a rotatable contact maker actuated by a cord.

932,799. COHERER. Walter W. Massie, Providence, R. I., assignor to Massie Wireless Telegraph Company. Filed August 16, 1905. Describes the details of a device comprising a coherer and tapper.

932,819. OSCILLIAMETER. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed December 11, 1906. A combined wavemeter and wave producer comprises a variable condenser, an inductance element, a scale for indicating the natural period of the combined condenser and inductance, and an incandescent lamp in series with the condenser and inductance as an indicating means.



932,835.—ELECTRIC FURNACE.

932,820. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed August 19, 1907. Comprises an oscillating circuit containing pairs of inductance and capacity, said pairs connected in parallel, means for charging the capacities, and means for discharging the capacities through a closed circuit containing only the capacities and inductances.

932,821. TELEPHONE AND TELEGRAPH TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed July 25, 1908. A substantially continuously oscillating circuit has a relatively low natural period, and a high-frequency oscillation circuit is associated with the first-mentioned circuit and derives energy therefrom, and radiating conductor is associated with these.

932,834. SHADE-HOLDER FOR ELECTROLIERS. Henry A. Torrey, Waterbury, Conn., assignor to the Plume & Atwood Manufacturing Company. Filed March 25, 1909. A holder for a shade or globe comprises two members, one of which is adapted for connection with the socket and the other of which is adapted together with the shade or globe for an axial and telescoping movement upon and with reference to the first aforesaid part.

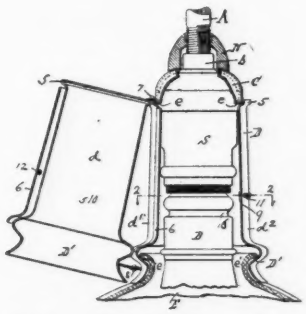
932,835. ELECTRIC FURNACE. Jean B. Trillon, St. Jeoire, France, assignor to himself and La Societe Electrochimique du Giffre, St. Jeoire, France. Filed July 6, 1907. Comprises at least two independently adjustable electrodes of opposite polarity, in which the sole and conducting bath form a part of the generating circuit and at least two hearths are formed, and a third conductor between this sole and a selected point of the generating circuit to allow of the return of the electric current wholly or partly through this third conductor.

932,841. BATTERY-COVERING. George E. Andrews, Providence, R. I. Filed May 21, 1909. A bag-like member of rubber is provided with thickened portions, and with holes extending through these thickened portions for the purpose of receiving wires, the bag-like member being thickened at one of its edges for the purpose of excluding the entrance of water.

932,863. CIRCUIT-BREAKER. John B. Howe and Harvey E. Howe, Windber, Pa. Filed March 19, 1909. In combination with coupling members and an insulated piece connecting the members and having a lower edge V-shaped in cross-section, is a movable conductor piece substantially V-shaped in cross-section normally supported out of engagement with the coupling members by the insulated piece.

932,877. AUTOMATIC SYNCHRONIZER. Howard Marshall, Vance, Colo. Filed October 6, 1906. In combination with an alternating-current machine, connected with an external circuit and an incoming machine, to be coupled in parallel therewith, are a secondary circuit, means controlled by the incoming machine for completing the secondary circuit, a closing switch for completing the coupling of the incoming machine with the external circuit, a resistance in the secondary circuit, and a vibrating means controlled by the secondary circuit for automatically operating the resistance and controlling the coupling switch.

932,883. PUSH-BUTTON ELECTRIC SWITCH. Lembert H. Moulthrop, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed November 12, 1908. Comprises an oscillating contact-carrying member and a detent, moving therewith, which comprises a spring which itself acts directly as the retaining member, in combination with means for freeing the detent.



932,893.—SHADE-HOLDER FOR ELECTRIC LAMPS.

932,893. SHADE-HOLDER FOR ELECTRIC LAMPS. Granville E. Palmer, Boston, Mass., assignor to the Price-McKinlock Company. Filed March 19, 1909. A lamp socket shade holder comprises a casing to be supported from the cap of the socket and to inclose the latter and made in three vertical sections, two of which are permanently secured together, the third section being hinged at one side to one section, and means to latch it on the other side to the other section, the several sections having flanged lower ends to engage the shade.

932,896. ELECTRIC MOTOR. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Filed June 21, 1909. A motor or generator comprises a casing having a retaining device at one end, a field formed of disks fitted in the casing and held at one side by the retaining device, and a retaining ring co-operating with the opposite side of the field.

932,897. DYNAMO-ELECTRIC MACHINE. Alvin A. Pifer, Cleveland, Ohio, assignor to the Cleveland Armature Works, Cleveland, Ohio, a partnership. Filed April 1, 1909. Has a number of poles, each with two separate pole-shoe sections adapted to be moved toward and from each other circumferentially about the armature, the forward surface of each shoe section being tapered inward so as to coincide substantially with an extension of a radius drawn from the center of the armature.

932,898. ART OR PROCESS OF PRODUCING OZONE. James F. Place, Glen Ridge, N. J. Filed February 26, 1909. The process comprises evaporating liquid oxygen by heat drawn from a column of air in a pipe submerged therein, and subjecting

the cold vapor and oxygen gases from the evaporating liquid to an electric current in an ozonizer.

932,913. RECEIVING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed April 28, 1905. Includes a looped aerial conductor, a wave-responsive device connected in one leg of the loop, an adjustable inductance bridging the legs of the loop, a condenser connected with the wave-responsive device and the inductance in a closed local circuit, and a signal-reproducing means controlled by the wave-responsive device.

932,923. TRAIN-STOPPING SYSTEM. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Filed August 15, 1908. A contact member on the train completes a local circuit and operates a relay which actuates a valve-opening motor to control the air brakes.

932,924. CONTACT-MAKER. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Original application filed August 15, 1908. Divided and this application filed August 26, 1908. A contact-maker for train signaling and stopping mechanisms and the like comprises a plate, a switch mounted thereon, contact bristles pendent from the plate, and means carried by the plate for actuating the switch.

932,925. CLOSED-CIRCUIT WIRING FOR AUTOMATIC TRAIN-STOPPING SYSTEMS. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Filed September 1, 1908. Describes in detail the connections for a sectionalized block system.

932,926. TRAIN-STOPPING SYSTEM. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Original application filed September 1, 1908. Divided and this application filed February 3, 1909. Describes electrical connections for a block system at a point where a line crosses a main line.

932,928. APPARATUS FOR THE CONTROL OF RAILWAY TRAINS. Robert J. White, Wilkinsburg, Pa. Filed January 15, 1908. Apparatus for the control of railway trains comprises indicating mechanism on each train for indicating at any time the actual distance traveled by that train, other indicating mechanism on each train for indicating the actual distance traveled by another train, connection for establishing an electric circuit between successive trains, and means on each train for affecting the electrical circuits to thereby actuate indicating mechanism on another train or trains.

932,966. ELECTROTHERMOSTATIC HEAT-REGULATOR. Lloyd G. Copeman, Berkeley, Cal. Filed October 1, 1908. Comprises a movable electrical heater, with interior resistances and a main heat circuit, a hood in fixed relation with the heater, a thermostat located within the hood and the heat zone of the heater, a shunt circuit controlling the main heat circuit, and connections between the thermostat and the shunt circuit.

932,970. ELECTRIC-LIGHT-CORD ADJUSTER. Owen Dodge, Colorado Springs, Colo. Filed October 12, 1908. A spring-actuated drum rotates within a stationary supporting frame for an electric-light hanger, and a suspension cord is attached to the drum.

932,984. TROLLEY-POLE BASE. Charles C. Hale, Wapakoneta, Ohio. Filed February 17, 1909. The vertical standard rotates on ball bearings above and below its enlarged disk-like end.

932,986. TRANSFORMING SMELTING-FURNACE. Hugo Helberger, Munich, Germany. Filed September 11, 1908. A transformer furnace embodies a transformer having terminal electrodes of its secondary windings located in proximity to and directly connected with the windings, whereby current losses are reduced, the electrodes having oppositely disposed contact faces for clamping a melting crucible between them and clamping means separate from but engaging the electrodes to clamp a crucible between them.

933,012. CIRCUIT MAKING AND BREAKING DEVICE. Henry S. Baker, Wilkinsburg, Pa. Filed March 23, 1906. Has a stationary contact terminal, a flexible switch arm to engage therewith, and a retarding device attached to the free end of the switch arm.

933,018. TELEPHONE SYSTEM. Edward R. Brodton, Mobile, Ala., assignor of one-third to George H. Fonde and one-third to Ernest E. Wagar, Mobile, Ala. Original application filed November 19, 1907. Divided and this application filed June 29, 1908. The system comprises means for propagating trains of waves, including an induction coil, means for receiving trains of waves, and including signals actuated by the effect of these waves, and a telephone transmitting and receiving system, including the induction coil, and means for grounding two sides of the same at two points spaced apart.

933,027. ABNORMAL POTENTIAL-DISCHARGING AND ARC-DISRUPTING DEVICE. Frederic W. Erickson and Frederic W. Lord, New York, N. Y. Original application filed April 27, 1907. Divided and this application filed July 11, 1907. Spaced terminals are located within the current path, and a rotor has an insulating disk permanently extending between the terminals. The axis of the disk extends in a direction parallel with and spaced from the line of shortest distance between the terminals, and the disk has a larger area than a cross-sectional area of the current path to provide an extended dissipating path, portions of which are successively positionable within the current path, the disk completing a revolution between successive passages of any given point thereof between the terminals.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 6, 1909:

481,959. CONDUIT SYSTEM FOR ELECTRIC RAILWAYS. Reuben Lawrence, St. Joseph, Mo.

481,975. METER FOR ALTERNATING ELECTRIC CURRENTS. Oliver B. Shallenberger, Rochester, N. Y.

481,979. APPARATUS FOR ELECTRICALLY PURIFYING WATER. Lucius T. Stanley, Brooklyn, N. Y.

481,989. ELECTRIC FIRE AND BURGLAR ALARM CONNECTION. Homer T. Wilson, Louisville, Ky.

481,999. ELECTRIC FURNACE GENERATOR. Emile Berliner, Washington, D. C.

482,012. BATTERY CONNECTOR. Edward R. Knowles, Brooklyn, N. Y.

482,015. PRINTING OR RECORDING TELEGRAPH. Zachary T. Lillard and Ursinus Erhard, Kansas City, Mo.

482,031. TROLLEY FOR ELECTRIC RAILWAYS. Clarence A. Adams and Thomas J. Thorp, Lincoln, Neb.

482,032. ELECTROSTATIC SWITCH AND PHASE INDICATOR. Alfred U. Alcock, Melbourne, Victoria.

482,043. STORAGE BATTERY. Patrick Kennedy and Charles J. Diss, Brooklyn, N. Y.

482,074. ELECTRICAL HEATER. John V. Capek, New York, N. Y.

482,104. CEILING BLOCK FOR INCANDESCENT LAMPS. Luther Stieringer, New York, N. Y.

482,126. TRAIN-SIGNALING APPARATUS. James M. Henry, Wilmerding, and Robert B. Wilson, Altoona, Pa.

482,129. COMBINED TELEGRAPH KEY AND SOUNDER. Dan J. Ludwig, New York, N. Y.

482,133. ELECTRIC ALARM CLOCK. John McMillan and George H. Taylor, Philadelphia, Pa.

482,136. AUTOMATIC BATTERY CUT-OFF. Walter S. Richards, Natick, Mass.

482,137. ELECTRICALLY-ADJUSTING RELAY. Walter S. Richards, Natick, Mass.

482,139. ELECTRIC VALVE CONTROLLER. Edward F. Roberts, Columbus, Ohio.

482,148. TELL-TALE FOR ELECTROLYTIC REFINERIES. Francis B. Badt, Chicago, Ill.

482,149. ELECTRICAL CIRCUIT AND CABLE. John A. Barrett, Brooklyn, N. Y.

482,150 and 482,151. ELECTRIC CONDUCTOR. John A. Barrett, Brooklyn, N. Y.

482,152. ELECTRIC CIRCUIT AND CABLE. John A. Barrett, Brooklyn, N. Y.

482,157. ELECTRIC ARC LAMP. John T. Birch, Pittsburg, Pa.

482,172. ELECTRICAL GAS LIGHTER. James E. Hamilton, Chicago, Ill.

482,174. TELEPHONE-EXCHANGE APPARATUS. Angus S. Hibbard, New York, N. Y.

482,181. ELECTRIC CONNECTOR FOR HOSE. Charles F. Kellom, Delair, N. J.

482,209. INDUCTION COIL FOR ELECTRIC METERS. Elihu Thomson, Lynn, Mass.

482,240. ELECTRIC ARC LAMP. James E. Gaston, Sparta, Ill.

482,251. WATCHMAN'S ELECTRIC TIME-RECORDER. Emanuel R. Heyser, Leon, Mex.

482,253. ELECTRIC ARC LAMP. Jesse F. Kester, Terre Haute, Ind.

482,263. ELECTRIC ANNUNCIATOR. Erastus D. Moore, New York, N. Y.

482,265. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. John Nebel, Charlton, England.

482,328. ELECTRIC CABLE. John A. Barrett, Brooklyn, N. Y.